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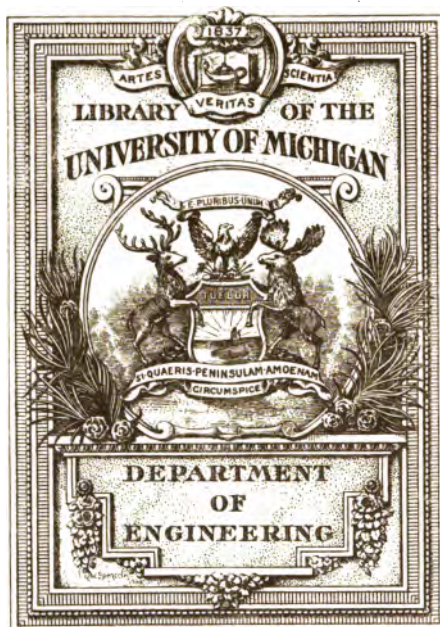
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ELEMENTS *of* MODERN
FIELD ARTILLERY

U. S. SERVICE

LIEUT.-COL. HARRY G. BISHOP



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ELEMENTS
OF
MODERN
FIELD ARTILLERY
U. S. SERVICE
(2nd Edition—Revised)



BY
LIEUT.-COLONEL HARRY G. BISHOP
8th Field Artillery
(Formerly Instructor, Department of Military Art at the
Army Service Schools, Fort Leavenworth, Kansas.)



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P R E F A C E

This publication is purely a compilation; no originality is claimed. It is not possible to list all of the publications consulted in its preparation but the following are the principal ones:

Drill Regulations for Field Artillery, U. S. Army, 1911 (ab. F. A. D. R.), Gunnery and explosives for Field Artillery Officers, Westervelt (ab. G. and E.); Field Service Regulations, U. S. Army (ab. F. S. R.); Cavalry Drill Regulations, U. S. Army; Infantry Drill Regulations, U. S. Army (ab. I. D. R.); Notes on Field Artillery, Spaulding; Letters on Artillery, Hohenlohe; The Tactical Employment of Quick Firing Field Artillery, Rouquerol; Modern Field Artillery in the Field, Bethel; Field Artillery With the Other Arms, May; A Critical Study of German Tactics, Pardieu; The various Handbooks of Field Artillery Matériel, Ordnance Department, U. S. Army; and numerous articles in the Journal of the U. S. Field Artillery and other military periodicals.

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H. G. B.

Fort Sill, Oklahoma,
November, 1918.

P R E F A C E

Second Edition

The cordial reception by the public of the first edition of this book has warranted another edition. This edition conforms to the new Drill and Service Regulations for Field Artillery, just issued by the War Department, and an effort has been made to incorporate the principal changes in the art and science of Field Artillery occasioned by the present European conflict. Our knowledge of what is occurring on the battlefields abroad is very imperfect, especially in the details, but it is believed that the latest principles governing the use of Field Artillery are herein noted.

H. G. B.

San Francisco, Cal.,
April 15, 1917.

III

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CHAPTER I

INTRODUCTION

These notes are a compilation of the notes used in conferences on the subject of Field Artillery at the Army Service Schools. The limited time allotted the subject at the Service Schools required considerable condensation of the subject matter and the sole idea of the notes is to provide a ready reference to the ideas of the foremost field artillerists. The notes cover only such matter as will be of value to officers of the other arms of the service in explanation of the powers and limitations of field artillery and matter, a knowledge of which will be of value to them when called upon to command mixed forces containing field artillery, or when required to inspect or umpire the work of field artillery commands. Details concerning drill, equipment, organization, personnel, preparation of firing data, adjustment of fire, and other technical matters are necessarily and purposely omitted.

These notes do not constitute a field artilleryman's text book; they are intended solely as a reference for the layman.

The Drill and Service Regulations for Field Artillery (1916) have been used as a basis in the preparation of this matter and as far as practicable the text is made up of extracts from standard works on the subject. The views advanced are the views of those foremost in the profession, and are in accordance with the Field Artillery Drill Regulations.

The modern quick fire matériel, particularly that of the armies of the world, its organization and fire tactics are almost identical. What is learned about the quick fire matériel of the U. S. Army is applicable to that of most foreign services and this knowledge may be the means not only of minimizing losses in our own troops but may contribute in no small measure to a successful issue on the battlefield.

The growing idea of the absolute inter-dependence of the three combatant arms—Infantry, Cavalry, and Field Artillery

and of the necessity for team work on the part of all three, and especially of the necessity for team work between the infantry and the field artillery or between the cavalry and its attached field artillery, render a knowledge of the tactics of field artillery absolutely essential to the infantryman or cavalryman in the application of his own tactics. The infantry officer who is thoroughly familiar with the characteristics of his supporting artillery, who understands its powers and limitations and can determine in advance, the probable manner of its use, can handle his own troops to far better advantage than if he is unfamiliar with these things. That is, he will be better able not only to dispose and move his troops so as to secure the maximum advantage of the field artillery fire but to so handle them as to provide greater opportunities for developing more nearly the maximum efficiency of the field artillery detailed for his support.

By this it is not intended to imply that every infantryman should be a field artillerist or vice versa. In this age of specialization, attempts to qualify in all of the details of each of the combatant branches is bound to result in mediocre achievements on the part of a large percentage of those making such an attempt, but officers of other arms must have some knowledge of field artillery to secure the full measure of its assistance and to avoid those errors so ludicrous at maneuvers, but which in time of war would be likely to jeopardize the issue and would certainly result in unnecessary losses of men and reputations.

The necessity for a knowledge of the characteristics and employment of field artillery on the part of General Officers, Chiefs of Staff, Adjutant Generals, Inspectors, and other staff officers is too apparent to need comment and if a desire for effective coöperation is not sufficient to cause officers of the other arms to acquire a knowledge of field artillery, the fact that they are likely to command or umpire mixed forces containing field artillery at any time in the field should furnish the necessary inducement.

While a knowledge of field artillery, its organization, powers, limitations, and fire tactics is desirable from the point of view of professional culture for officers of other arms, and while it is absolutely essential for coöperation and for the proper exercise of command over forces of which that arm is a part, there is another vital reason why infantry and cavalry officers should become familiar with this arm and with its fire tactics. This reason is, that such a knowledge will be of inestimable value to the infantryman and cavalryman, even to the junior officers and to the noncommissioned officers of those arms in attacking hostile artillery, and will be particularly valuable in adopting formations and in regulating movements of their troops for the purpose of avoiding or minimizing the effect of hostile artillery fire when compelled to operate within its effective radius.

As a general thing the field artillery officer has some knowledge of the tactics of infantry and cavalry, acquired either at military schools or by previous service in one or the other of those arms. Also, field artillery is rarely, if ever, stationed apart from the other arms and much information concerning the other arms is acquired by the field artillery officer from this association. The reverse is not true. Very few officers of the other arms have had any service with modern field artillery, either at schools or as enlisted men in that branch and there are many infantry and cavalry posts where no field artillery is stationed. Thus, this arm is practically unknown to a great proportion of officers of other arms and recourse must be had to books and other writings for the acquirement of any information concerning it.

The quick fire matériel adopted for U. S. service and that of all the leading armies of the world has been in actual existence less than twenty years. It has been tried out in only one war, the recent war in the Balkans. It is being thoroughly tried out in the present European war but so far there is very little authoritative data regarding details of its use. Therefore, there is little in print, comparatively speaking, concerning this matériel and its tactics and next to nothing in print

that is readily intelligent to officers of the other arms without constant reference to other books, a process that discourages study of any subject. It is the purpose of this work to put between the covers of one book a consecutive and complete but not detailed résumé of the subject.

At first glance the subject of field artillery seems highly technical. Within the firing unit, the battery, this is partially true. The handling of the firing plant requires a high degree of intelligence and natural ability and a fair degree of perfection in its use can be acquired only by a great amount of constant practice. These technicalities are, however, for the field artilleryman to handle. Officers of other arms need consider them only far enough to gain an appreciation of the powers and limitations of the arm. It is the second purpose of this work to explain the powers and limitations of the arm, to enunciate the general principles upon which the battery or other field artillery unit is handled tactically and to illustrate the application of these principles under the various circumstances of coöperation with infantry or cavalry with one or both of which, the field artillery must habitually operate. This knowledge is essential for officers of the other arms, otherwise when called upon to command mixed forces containing field artillery they are certain to commit one of the two very common errors, viz: hampering it with such unwise and impossible orders that its potentiality is misapplied or wasted, or leaving it so utterly to its own devices, without even intelligent and necessary information that the same condition results.

A great deal of the universal lack of knowledge in the other arms concerning field artillery is chargeable in the past to the artillery itself. This was due to several causes. The first of these was the spirit of the old artillery generated by certain traditions acquired from foreign services and fostered by the policy of seclusion so universal and so skillfully practiced by our artillery previous to 1898. Other causes were the lack of a proper organization most seriously felt in the dearth of field officers and in the deficiency in the amount of field artillery itself.

These matters are not only interesting historically but a few words concerning them will serve to explain some of the

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motives underlying the principles of the employment of field artillery in coöperation as exemplified by our present drill regulations, and will serve to prevent possible recurrence in the future.

Up to the beginning of the nineteenth century the artillery was generally regarded as a species of skilled mechanics rather than soldiers. Quoting Hohenlohe: "This was in part their own fault. The little they had to learn more than other soldiers in order to discharge the duties of their profession was exaggerated by them into a great science, which being surrounded by a veil of impenetrable mystery, kept soldiers of the other arms at a distance as its substance appeared more wearisome by the diffuseness of its treatment. I need only refer to the chapter, 'on the art of making paper and paste' with which at that time, every manual of artillery began or to the books of geography, history, and the higher mathematics, which formerly formed part of the equipment of the limber of every field gun. The gunner of those days took pleasure in a mask of learning under a veil of mystery, which, though it estranged the other arms from the artillery, yet caused them to entertain a certain respect for it on account of its unknown erudition."

It was apparent, however, to many artillery officers that by these methods they could not secure for their arm the necessary coöperation for maximum efficiency in its use in time of war and there arose a feeling that proper tactical coöperation could only exist with proper social relations with the other arms and the tendency of the arm to draw nearer to the others in social matters grew more general. But for a long time certain regulations existed (Prussian Artillery) that were the cause of friction and stood as stumbling blocks to the growth of that close social union, the existence of which alone insures coöperation. The first of these was the "promise of secrecy." By it every officer of the Prussian artillery was strictly forbidden to betray anything whatever of the "secrets" of the artillery beyond the regiment. As nothing that he learned was particularly branded as a "secret," he was perforce effectually stopped from conversing about his arm with officers of other arms.

Another Prussian regulation interfered even more with the tactical employment of the arm. This regulation was to the effect that every artillery officer was made personally responsible for its employment in action and in maneuvers, even when he had to obey the orders of a superior officer. If an artillery officer received an order with regard to some tactical disposition which he did not consider right, he was compelled to protest, and was relieved from responsibility only in case his protest was overruled. As Hohenlohe goes on to say: "In consequence of this principle, indiscipline, insubordination, the spirit of contradiction, and the art of making difficulties was skillfully taught the young officer," and the general result was to let the young artilleryman alone with his technicalities and his "secrets." As Napoleon expressed it: "Let the gunners alone, they are an obstinate lot." Thus the artillery, despite the fact that it is capable of fire action alone and the least self sustaining of all the arms, in fact an arm almost incapable of producing decisive results alone, came to occupy a position of aloofness among the other arms; it was rarely consulted, and was ordered about and given tasks with hesitancy. The result was that the artillery did not sit high in the seats of the mighty and the other arms were deprived of the full measure of its assistance.

The effect of these causes of friction was felt in our own service. During the civil war, though the hardships of severe campaigning did much to bring about some of the close social union of which Hohenlohe speaks, the field artillery was a thing apart more or less from the other arms and there was the same hesitancy about giving it orders or a total disregard of its capabilities when orders were given it, and the matter of its use was largely in the hands of the individual battery commanders and subject to their estimate and decision.

Until 1907 there was no permanent organization of the field batteries in the U. S. service into larger units and the lack of field officers was an almost hopeless obstacle to the development of coöperation and the dissemination of knowledge concerning the arm. During the civil war this lack of field

officers was deplorable. At the battle of Gettysburg, General Hunt, Chief of Artillery, reports that for the army artillery (not corps artillery) comprising some 67 batteries with 372 guns (320 of which were on the field) with over 8,000 men and 7,000 horses he had but one general officer (commanding the artillery reserves) and *four field officers*. There were *no field officers* with the corps artillery. The individual batteries were brave, well instructed, and resourceful and the guns were frequently fought to the point of annihilation of the personnel, but can one say that the infantry derived the full measure of the support that would have obtained if the artillery had not occupied such a position of isolation and had had a proper proportion of field officers to bring about some measure of coöperation?

Due to these old causes, imported from abroad and fostered by lack of organization, the light battery commander, viewing everything from the perspective of conduct of fire and from the limited viewpoint of only his personnel and matériel, continued to regard himself, his lieutenants, his horses, his men, and all things pertaining to his plant as things separate and apart from the rest of the garrison and the isolation of our light batteries, usually stationed, one at a post, continued and sanctified the custom until the separation from the Coast Artillery and the organization of the Field Artillery into battalions and regiments in 1907.

In the past six years all the *causes* for friction and aloofness have been removed, only fragments of their evil effects exist. Officers of other arms are evincing an interest in the matériel and tactics of field artillery that can only result in that close coöperation of the arms, without which a tremendous percentage of the power of these modern firing plants is wasted.

CHAPTER II

DEFINITIONS

There are a great many words and expressions used in the technique of field artillery which have a specific meaning. The following are some of those most important to officers

of the other arms and should be remembered not only as a matter of culture but for use in professional communication with the field artillery.

Conduct of fire: The employment of the technical means necessary to cause fire of the desired nature to be brought to bear upon the target.

Fire Direction: The tactical direction of one or more fire units with a view to bringing their fire to bear at the right place at the right time.

Fire Discipline: That condition resulting from training and practice which insures an orderly and efficient working of the personnel in the delivery of fire.

Rafale: A sudden burst, gust, or squall of shrapnel fire.

Registration: Adjustment of fire upon conspicuous objects in the sector assigned to an artillery organization. These objects are called *registration marks*.

Salvo: A single discharge from each of the guns of a battery or other unit fired in regular order from one flank to the other, with intervals of about two seconds.

Volley: The rapid discharge of a certain indicated number of rounds, by each gun of a battery or other unit, each gun firing without regard to the others.

Positions are defined as *masked* or *unmasked*, according as they afford concealment or not.

When no concealment is afforded, the guns are said to be in an *unmasked position*, and the fire is referred to as *unmasked fire*.

When concealment is afforded, the guns are said to be in a *masked position*, and the fire is referred to as *masked fire*.

The degree of concealment varies. Thus:

(a) If the guns are posted so that through the sights the hostile position can just be seen over the mask, they are said to have *sight deflade*.

(b) If they are posted where a dismounted man can just see the hostile position over the mask, they are said to have *dismounted deflade*.

(c) If where a mounted man can just see the hostile position over the mask, to have *mounted defilade*; and

(d) If so that the flash of the gun will be concealed, to have *flash defilade*.

The hostile position against which we defilade may be the target to be attacked; preferably, however, *defilade is taken against the highest position which the enemy's observing parties can occupy*.

Positions are described by the foregoing terms; thus the battery commander may be told to take a position for *masked fire*, *flash defilade*.

A defilade of four yards is sufficient to conceal the flash of the gun by day. A defilade greater than this is still referred to, however, as *flash defilade*.

If the position is on a reverse slope and the slope is fairly uniform, defilade of four yards may be quickly obtained as follows: Post a dismounted man and a mounted man covering each other, the first in position of dismounted defilade, the second in that of mounted defilade; then post the guns in rear of the mounted man a distance slightly greater than the distance separating him from the dismounted man. Complete concealment is obtained only in positions having flash defilade.

Artillery may be posted for *immediate action*, *in observation*, or *in readiness*.

When posted for *immediate action* the guns are unlimbered and fire is opened as promptly as possible upon the indicated targets. The position may be masked or unmasked.

When posted *in observation* the guns are unlimbered and all preparations made for opening at the desired moment upon the existing or expected targets. The position is usually masked.

When *in readiness* the guns are not unlimbered. They are held under cover near a position for possible immediate action, but so they can be moved quickly to another locality if the development of the tactical situation so requires. In the meantime the immediate tactical situation is studied, positions in the neighborhood for posting the guns to meet different eventualities are selected, and preparations are made for occupying

the selected positions and for promptly opening fire upon the existing or expected targets.

CHAPTER III

THE MODERN FIELD GUN

In 1892, General Langlois of the French Army gave to the world his now classic work entitled: "Field Artillery in Combination with Other Arms." In this book, from a thorough study of ancient and modern battles and all their attendant circumstances and exhaustive scientific discussion of the development of munitions of war and of the developments in other fields of modern endeavor he deduced the field gun of the future and its method of employment.

From having been looked upon as a chimerical dream, this gun became a reality in France about 1898. The principal changes, comparing it to the then existing guns, were in the methods of laying the piece and in so controlling its recoil that the gun would not "kick off" the target. The sighting or laying apparatus, while more speedy than former contrivances, was such that the gun could be laid upon the target by directing the laying apparatus on an auxiliary target or "aiming point." This improvement enabled the gun to be posted in a concealed, masked, or defiladed position with respect to its target, the only limitation to this defilade being naturally that the trajectory should clear the mask. This principle of "indirect fire" was not a new one but the new apparatus and the methods for using it were a vast improvement over all existing ones particularly in the matter of speed and accuracy.

The second improvement, control of the recoil, held the gun after each shot to its previous laying and this, with improvements in the breech mechanism and in the ammunition, made the piece a true rapid fire gun.

Other nations began by pooh-poohing the gun, Germany in the lead, then passed to the state of modifying their existing equipment and ended by throwing it all in the scrap heap and building an artillery equipment on the same general lines as the French. This is the present rapid fire gun, which the entire

world, including the United States, has been forced to adopt, against its will, and at an expense of hundreds of millions of dollars.

The guns in use during the Russo-Japanese war by both sides though often spoken of as "rapid fire guns" were not the guns above referred to. They were what is technically known as "accelerated fire guns," a class falling between our 3.2 gun of 1898 and our present true "rapid fire gun." The true rapid fire gun, therefore, received no test in this war. Its first appearance on a battlefield of any magnitude was in the recent Balkan war. Accurate or detailed accounts of its performance there are lacking at the present writing, but it would appear from such reports as have been received concerning it that this supreme test will not cause any radical change in the gun or in the adopted principles of its technical and tactical use and the same is true for the present European war.

The guns and howitzers adopted for the field artillery service of the United States are all true rapid fire guns in the above described sense. They all have similar laying and sighting apparatus, they all have the same method of recoil, the system of fire control for each class is analogous, their formations, drill, and maneuvers are almost identical, and there is little variation in their ammunition except in the calibres.

The three inch gun which is the predominating calibre and the gun which will be most in evidence is selected as the type for discussion in these notes.

CHAPTER IV

CHARACTERISTICS OF THE ARM

Fire action is the primary characteristic of field artillery and in this it differs from all other arms. There have been isolated cases of field artillery using shock action as when Ramsey's horse battery at Fuentes de Onoro finding itself cut off by French cavalry limbered up, charged, and cut its way out, also the mounted detachments of the Prussian horse artillery formerly were trained to execute a charge to permit

a withdrawal of the guns in case of imminent danger, but this is not artillery work; the isolated cases are the exceptions that prove the rule and there is nothing in the drill regulations of any modern army that could be construed to attribute anything but fire action as the chief characteristic of field artillery.

The first step in the development of early artillery was to increase the weight, size, and range of its only projectile—the round shot, thus multiplying its battering power. Next it was discovered that greater effect could be produced, especially against animate objects, by laying the piece so that the projectile would bound or ricochet through its target, thus increasing the danger space, and giving distribution in depth. Grape shot was then introduced giving distribution in breadth as well as depth, but at the expense of range. The same was true of canister. The round shot has now been superseded by the shell for battering or demolition effect, and grape and canister by the shrapnel, the properties of both of which will be considered later more in detail.

Mobility was always appreciated as a controlling factor but not always adhered to in early gun construction and efforts were constantly made to increase the rapidity of fire.

It is thus seen that the chief component—*ability to sweep an area*—of the chief characteristics of the field gun—*fire action*, was early appreciated. But military men were slow to appreciate the fact that to get the most out of this ability to sweep an area the guns should be grouped in units of various sizes to suit the ever varying occasions and up to very recent times we find field guns attached singly or in pairs to infantry battalions—the “battalion guns”—though history records many instances of massing them on special occasions.

A theoretical consideration of the characteristics of the weapon and all practical experience proves conclusively the soundness of the present universal system of grouping the field guns into permanent tactical units, thus realizing another prime characteristic of the arm—*great power concentrated in a relatively small tactical unit*.

With the great range of the modern field gun and the improved means of communication, concentration of fire may

now be secured without the evil of former times, concentration of guns.

Our present Field Artillery Drill Regulations sum up the characteristics of modern field artillery in the following concise statement:

1. Great power concentrated in a relatively small tactical unit.
2. Rapidity of fire.
3. Long range.
4. Ability to act from concealed positions.

The first characteristic facilitates intelligent direction. It enables a commander to hold a powerful force well in hand and to bring it to bear with the desired intensity at the proper place and time.

The second characteristic enables artillery to bring a crushing fire to bear upon a vulnerable enemy before he can escape from its action.

The third characteristic permits artillery great freedom of action enabling it to interpose effectively over a broad terrain and to secure the concentration of effort of widely dispersed units.

The fourth characteristic facilitates establishing the guns in favorable positions, acting by surprise, preserving freedom of maneuver, and makes it possible for inferior artillery to remain on the battle field.

Field artillery, on the other hand, has certain limitations which prevent its employment as an independent, self-sustaining arm. Among these may be mentioned:

- (a) It is unable to act otherwise than by fire.
- (b) It is extremely vulnerable when exposed in the open to percussion fire at medium ranges; also if exposed to shrapnel fire when in route formation or when in the act of occupying a position, as it can protect itself only with difficulty by fire action, concealment or escape.
- (c) Even when unlimbered it defends itself with difficulty against attacks on its flanks and rear. (F. A. D. R. Par. 1464)

Particular attention is called to the limitations of field artillery and to the following from our Infantry Drill Regulations which very well describes its inability to sustain itself under certain conditions:

A frontal infantry attack against artillery has little chance of succeeding unless it can be started from cover at comparatively short range. Beyond short range, the frontal fire of infantry has little effect against the artillery personnel because of their protective shields.

Machine guns, because their cone of fire is more compact, will have greater effect, but on the other hand they will have fewer opportunities and they are limited to fire attack only.

As a rule, one's own artillery is the best weapon against hostile artillery.

Artillery attacked in flank by infantry can be severely damaged. Oblique or flank fire will begin to have decisive effect when delivered at effective range from a point to one side of the artillery's line of fire and distant

from it by about half the range. Artillery is better protected on the side of the caisson.

Guns out of ammunition, but otherwise secure against infantry attack, may be immobilized by fire which will prevent their withdrawal, or by locating and driving off their limbers. Or they may be kept out of action by fire which will prevent the receipt of ammunition.

Artillery when limbered is helpless against infantry fire. If caught at effective range while coming into action or while limbering, artillery can be severely punished by infantry fire.

In attacking artillery that is trying to escape, the wheel horses are the best targets.

The purpose of the artillery support is to guard the artillery against surprise or attack.

Artillery on the march or in action is ordinarily so placed as to be amply protected by the infantry. Infantry always protects artillery in its neighborhood.

The detail of a support is not necessary except when the artillery is separated from the main body or occupies a position in which its flanks are not protected.

The detail of a special support will be avoided whenever possible. (I.D.R. Pars. 575-580 inclusive)

Field artillery, while a powerful auxiliary to other arms, is not self sustaining under certain battlefield conditions.

A discussion of the characteristics of the arm would not be complete without the following extract from an address by General M. M. Macomb before the National Guard Convention, October, 1910:

The Modern Battery a "Firing Machine":

The characteristic of field artillery is the concentration of power in a limited space. The front of a battery in action is only about 100 yards; the battery is controlled by one man, the captain; it is capable of delivering its fire anywhere within a sector of seven thousand yards radius; there may be several shrapnel, each with its 262 balls in the air from the same gun at the same time; there are four guns in the battery; and all this volume of fire can be delivered by a single command of the captain. Such a blast is termed by the French a "rafale," and means literally a "squall"—and it appears to be well named. As it would be impossible to bring up on the battlefield sufficient ammunition (each complete round weighing 18½ lbs.) to continuously feed such a battery it is planned to suddenly and by surprise turn such a squall on the target, and as soon as sufficient effect is produced, to suspend the fire, or turn it to some other target. Squalls of fire, interrupted by pauses, have, therefore, superseded the old idea of continuous slow artillery fire.*

* A rapid and continuous fire may be inaugurated to operate as a "curtain" or barrier or a prolonged bombardment against a well-intrenched enemy may be necessary.

A battery is thus a firing *machine*, operated by the captain, who may play four lines of fire from his battery at will; this sheaf, composed of the four lines of fire, he may shift to the right or left to strike a new target, up or down vertically for new ranges; he may sweep across the range or up and down it; he may play one or more lines upon one target and the balance upon another; in short, there is the greatest flexibility to the fire action of a field artillery unit. Theoretically, all this is true. But here I want to make a statement and to lay special emphasis on it. No matter how perfect a machine may be mechanically, and no matter how efficient it may be theoretically, it is in practice no better or more efficient than the operator. The finest locomotive or automobile ever built responds only to the amount of skill possessed by the driver. A firing battery, like the locomotive or automobile, is worse than useless in the hands of the inexperienced, untrained man. And training takes time, opportunity and practice. (Arms and The Man)

To this excellent pen picture of a modern battery may well be added: While a good company of infantry or a good troop of cavalry may render excellent battle service under a poor captain, the best field artillery battery in the service is not worth the front it occupies, if it is commanded by an inexperienced or inefficient captain. The control of its fire action, its chief characteristic, is so completely vested in its commander that it lies wholly in his power to make or break its efficiency when it is called upon to exercise this chief characteristic.

CHAPTER V

FIELD ARTILLERY OF THE UNITED STATES SERVICE AND ITS CLASSIFICATION

Field artillery may be, and usually is, classified according to its mobility, as the characteristic of mobility governs its tactical assignment to mobile units and very largely its tactical use. Under this classification we have in the U. S. service:

Mountain Artillery, or Pack Artillery.

Light Field Artillery.

Horse Artillery.

Heavy Field Artillery.

Field artillery ordnance may also be classified according to its *kind* of fire, into guns and howitzers.

The following field artillery ordnance has been designed for the U. S. Service:

	Calibre:	Designation:	Weight of projectile:	Weight behind team:
Light	3."0	Mountain Howitzer	15 lbs.	Packed on mules about 800 lbs each
	3."0	Field Gun	15 lbs.	4200 lbs.
	3."8	Howitzer	30 lbs.	4200 lbs.
Heavy	4."7*	Howitzer	60 lbs.	5250 lbs.
	4."7	Field Gun	60 lbs.	8750 lbs.
	6."0	Howitzer	120 lbs.	8600 lbs.

*Classed as *light field artillery* when horsed with a team of four pair and as *heavy field artillery* when horsed with a team of three pair.

Mountain Artillery: This howitzer is intended primarily for rough country impracticable for wheels and is packed on mules. The piece weighs about one-third as much as the light field gun but fires the same weight projectile. Its ballistic qualities must therefore be much reduced below those of the 3" gun. Hence its range is much shorter, but this is of little moment in close, mountainous country where action will be at short ranges. On account of its mobility, and ability to be advanced readily under cover it has been proposed to make a few of these pieces an integral part of the infantry division, to constitute the "accompanying batteries" or batteries which keep up with the infantry lines.

Light Artillery: This is a term of long standing in our service and corresponds to the special designation "field artillery" abroad. Our 3" field piece is the principal gun normally assigned to the infantry division. The gun for this purpose is practically standard the world over. The cannoneers are mounted on the carriages. The gun will be described in more detail later.

Horse Artillery: This ordnance is designed to accompany cavalry. Its mobility must therefore exceed that of the gun with the infantry division. In some foreign countries this is secured not only by removing the cannoneers from the carriages but by reducing the calibre and consequently the weight behind the teams. In our service we have preferred to use the same piece for horse artillery, for one reason to avoid complication in ammunition supply, and have lightened the weight behind the teams by mounting the cannoneers on saddle horses, and by reducing the amount of ammunition carried. Whether

or not the piece is sufficiently mobile to answer all purposes is a question not yet determined. The difference in mobility between light field artillery and horse artillery is not so apparent at casual inspection, but is readily perceived when roads are bad, work continuous and forage is scant. Another function of horse artillery is the quick reënforcement of critical points of the battlefield. There are many instances in the Franco-German war where the more mobile horse artillery arrived at critical times far ahead of the light artillery and in the Russo-Japanese war the lack of horse artillery on the Japanese side prevented them from ever converting a Russian retreat into a rout. The road space of our horse artillery is greater than that of our light field artillery and it is slower in limbering and unlimbering due to time lost in dismounting and linking the saddle horses.

The 4".7 Gun: This gun is a true heavy field artillery gun. It takes up the work where the light field gun leaves off and in conjunction with the 6" Howitzer has been designed with the view of breaking through any fortifications that can be constructed by troops in the field. It fires both shael and shrapnel. In addition to its power against field works, its long range makes it of great value in covering the flanks of any army and in forcing the enemy to long detours in enveloping or flanking movements. The gun is too heavy for normal assignment to the infantry divisions, and will generally be found with the "Army Troops" to be brought to the front when necessary.

The 3".8 Howitzer: This is the true light howitzer and will normally be found in the infantry division along with the 3" field gun. It supplements the direct fire of the 3" gun with its curved fire. The reason for this intermediate calibre is undoubtedly ammunition supply,—its ammunition weighing only half that of the 4".7 Howitzer.

The 4".7 Howitzer: The weight behind the team of this piece is such that if horsed with a team of three pairs it must be classed as a piece of heavy field artillery, but if with a team of four pairs its mobility is so increased that it can be classed

as light field artillery and when so horsed will be found in the artillery of an infantry division along with its companion piece the 3".0 gun. When not so horsed it belongs ordinarily with the "Army Troops" to be brought up when needed.

The 6".0 Howitzer: This howitzer is the companion piece of the 4".7 gun and similar remarks apply to it. To quote the Field Artillery Board, "The 6" howitzer is the most powerful and efficient field artillery weapon known to the Board. The results of its use during every stage of the test were impressive to every observer, and the Ordnance Department is to be congratulated in having evolved a weapon which outclasses every other weapon of the same or nearly the same calibre used by any other nation and known to the Board." Speaking of the effect on field fortifications the Board further says: "Furthermore while (the Eng. Officer) recommends a uniform overhead cover of 10 feet with 12" timber over the bomb proof, it is extremely doubtful whether this amount of cover would afford complete protection against the 6" Howitzer. . . . the 6" howitzer produced such tremendous effect combined with such accuracy of fire, with a travel in earth of its projectile of over 21 feet, that the question of getting through a 10 foot overhead cover is, in the opinion of the Board, simply a question of expenditure of ammunition when firing at ranges which give an angle of fall of from 40° to 45°."

As stated in Chapter III, these notes are based on the three inch matériel with the exception of a single chapter later, on Heavy Field Artillery. The principles governing the employment of the calibres other than the three inch are practically the same with only a few obvious departures. For example, the mountain howitzer is more mobile than any of the other calibres in difficult country or in close proximity to the enemy. However, as its personnel march on foot, it is limited in speed of travel to more nearly that of foot troops. To retain the same calibre as the three inch gun and yet reduce its weight to that figure permitting to be transported on mules, its ballistic qualities have suffered. Our horse artillery is more mobile than the light field batteries, but the guns are identical

and can be counted on for the same class of work. The heavy artillery is less mobile but has superior ballistic qualities.

The European war has established the necessity for still larger calibres, the Germans having produced a 16".5 mortar and the French, a 18".8 gun mounted on a railway carriage. Two types of larger calibre howitzers have been recommended for our service.

CHAPTER VI

THE THREE INCH MATÉRIEL

Complete and detailed descriptions of the three inch matériel and of the other field artillery calibres are to be found in the Ordnance Department publications. It is not within the province of these notes to go into any detailed description of the piece or its ammunition.

Gun: The gun itself is "built up" of nickel steel forgings consisting of tube, jacket, locking hoop and clip, shrunk into place. Its breech mechanism is of the interrupted screw type, opened and closed by a single horizontal motion of the operating lever. Since fixed ammunition is used no obturating device is necessary. An extractor in the breech throws out the empty cartridge when the breech is opened. Percussion primers being used in the ammunition, a firing pin and appropriate mechanism are contained in the breech block. The piece is fired by a trigger fixed to a nonrecoiling part of the carriage. The gun proper rests in a cradle in which it has only longitudinal motion. Recoil is controlled by means of an hydraulic cylinder and piston, the cylinder and gun recoiling in the cradle, the piston attached to the cradle remaining stationary.

Recoil is checked by the combined resistance of the cylinder oil against the piston head and by a set of helical springs within the cylinder. These springs, compressed upon recoil, return the gun to battery.

The cradle is pivoted upon a rocker and has a motion in azimuth about this pivot so that the gun may be traversed some 4 degrees right or left independent of movements of the

trail. The rocker is jointed to the axle and connects the upper carriage so to speak with the lower carriage, which consists of wheels, axle and trail. By a double screw arrangement the piece is elevated or depressed. Both elevation and movement in azimuth are given by easily turning hand wheels. The carriage is mounted on two wheels, the third point of support being the trail, which is provided with a spade and float at its ground end. This spade is ordinarily buried at the first shot and holds the carriage stationary during subsequent firing. A steel plate shield, proof against puncture by the service rifle at 100 yards protects the cannoneers from rifle and shrapnel fire. Seats are provided for the gunner and one cannoneer when the piece is unlimbered. There are receptacles on the carriage for four rounds of ammunition for emergency use.

The appliances provided for pointing and laying the 3-inch fieldpiece include line sights, the adjustable or tangent sight, the panoramic sight, and the range quadrant, all of which are fully described in the handbook. The sighting apparatus, except in case of the line sights, is attached to non-recoiling parts of the gun carriage and remains in place during firing. As the carriage does not move, the gunner, with elevating and traversing handwheels conveniently at hand, finds the operation of sighting a continuous one.

Elevation and direction are given by moving the cradle to which the sight and quadrant are attached, by appropriate movement of the hand wheels.

Some form of telescopic sight is necessary, in view of the great range of the field gun and for the reason that indirect laying requires a sight permitting rapid laying of the gun when the target is hidden. These two requisites are combined in the panoramic sight, which is a telescopic sight so fitted with reflectors and prisms that the observer, with his eye at an eyepiece fixed in position, may bring into the field of view any object upon the horizon, the image appearing magnified, but otherwise as if viewed directly by the unaided eye. Due to the fact that with the telescopic sight the image of the target or aiming point is in the same plane as the cross wires, this

sight is more accurate than the tangent sight and requires less experience to use.

The range quadrant is for the purpose of setting off the proper range during indirect laying. For direct laying the sights are generally used, but for indirect laying the range quadrant must be used, since the angle of site of an aiming point bears no fixed relation to that of the target.

In order to take full advantage of the great range and accuracy of the service matériel and of the refinements of the sighting arrangements, a battery commander's telescope has been provided. This telescope is of the general form of the panoramic sight, but more powerful, and, with its all-around motion in azimuth and limited motion in elevation, becomes a satisfactory angle-measuring instrument. The scales of the telescope, sights, and range quadrant are so graduated that a reading may be transferred from one instrument to another without computation or reference tables. The telescope in present use will probably be shortly replaced by a more efficient instrument known as the "scissors" instrument.

For use in lieu of the telescope, a brass ruler, known as the battery commander's ruler is provided, by which angles may be roughly measured.

Limber: The limber is all steel except pole and wheels. Gun and caisson limbers are identical. The limber chest has space for 39 rounds of ammunition, but usually carries only 36, the other remaining spaces being taken up by oil cans.

Caisson: The caisson body carries one chest which will take 70 rounds of ammunition. The front of the chest is armoured. It carries an armoured apron which let down from the axle and with the rear wall, which opens up to 120° and catches and holds, forms a very complete protection for its cannoneers. Both limbers and caissons have attachments for carrying tools, picks, shovels, axes, etc., and also carry water buckets, picket ropes, and paulins.

Caisson and gun limbers are interchangeable as are also such parts as wheels, poles, singletrees, doubletrees, etc.

Battery and Store Wagon: Each battery is provided with one *battery wagon* and *forge* and one *store wagon*. The former

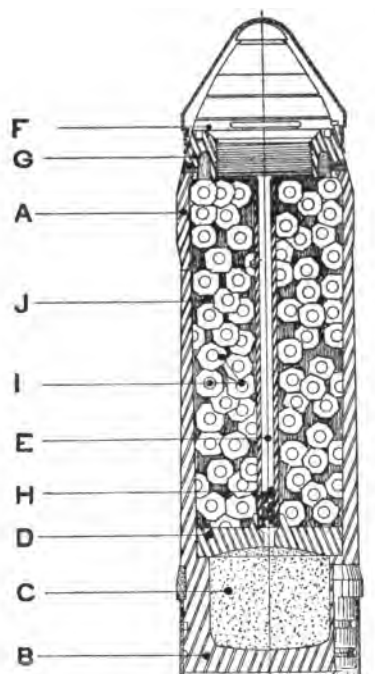
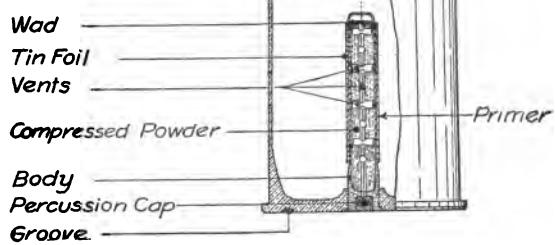


FIG. 1.



with its limber carries kits of carpenters', blacksmiths', and saddlers' tools, a forge and all necessary materials for shoeing. The latter has chests fitted to carry repair materials, spare parts and stores. Each wagon carries two spare wheels.

Draft: The system of draft is that of continuous traces throughout the team attached to pivoted singletrees and double-trees.

Accessories: Each battery is provided with megaphones, three field telephones and about one mile of buzzer wire, also field glasses for observation of fire.

Common Shrapnel: (Fig. 1) consists of a drawn steel case (A) with solid base (B). A bursting charge of black powder (C) is contained in the base of the case covered by a steel diaphragm (D). A central tube (E) connects the bursting charge (C) with the fuse (F) in the head (G) of the shrapnel. A small quantity of gun cotton (H) in the base of this tube is ignited by flame from the fuse and fires the bursting charge.

The case, above the bursting charge, is fitted with some 252 balls (I) each about $\frac{1}{2}$ inch in diameter. The interstices between the balls are filled with a smoke producing mixture (J), which upon explosion burns and renders visible the point of burst. When the bursting charge is fired the head of the shrapnel which contains the fuse is blown off and the case acts like a blunderbuss, the balls being expelled from the case with increased velocity and as they have at the same time the movement of rotation of the projectile they are dispersed more or less to the right or left. Their paths form a cone, called the cone of dispersion, about the prolongation of the trajectory. The section of the cone on the ground "the shrapnel pattern" is an irregular oval with its longer axis in the plane of fire.

The fuse has two elements, time and percussion. The time element enables the fuse, when properly set to burst the shrapnel at any desired point along the trajectory in air. If the fuse is not set for time fire, or, if so set and the time element fails, the percussion element causes burst upon impact.

The fuse may be set at zero, whereupon the shrapnel will burst at about 20 feet from the muzzle of the gun giving canister effect. The common shrapnel is essentially a projectile for attacking personnel and has little or no effect against walls or even light entrenchments. Used in an attack of a field work of even temporary type, its function is to keep down the defenders until our infantry can advance sufficiently to warrant a rush on the position.

High Explosive Shrapnel: By substituting an active for an inert matrix in the interstices between the shrapnel balls we produce a high explosive shell if it is detonated on impact, and have a common shrapnel if the fuse fires it in flight, as in the latter case the black powder bursting charge does not detonate the high explosive matrix but blows it out with the shrapnel balls and sets fire to it. Our service is being equipped with such a shrapnel.

The fuse of the high-explosive shrapnel, in so far as the time action is regulated, is the same as the present field artillery 21-second combination fuse, model 1907. The essential difference is that for the percussion ignition effect in the common shrapnel fuse a percussion-detonation effect has been substituted.

The high-explosive shrapnel affords the following advantages:

(a) It is a single-type projectile, hence obviates the difficulty of supplying two forms of ammunition. Heretofore much discussion has taken place regarding the proportion of shell to shrapnel. The problem, though indeterminate when two forms of projectiles are considered, is solved by the introduction of the single type.

(b) The high explosive shrapnel when employed as time shrapnel projects, in addition to the balls, a high-explosive head. This high-explosive head should be effective against the carriages of opposing artillery.

(c) High-explosive shrapnel has considerable shrapnel effect when bursting on impact, whereas common shrapnel is practically harmless unless striking on hard ground.

It should be understood that the high-explosive shrapnel is a compromise projectile, justified unquestionably by the resulting simplification of ammunition supply. The shell effect of the single-type projectile is slightly inferior to that of the high-explosive shell, and the number of balls contained in its case is fewer than in the common shrapnel.

Accuracy of Fire: The principal causes affecting accuracy of fire are:

(a) Errors committed by the personnel charged with the various incidents of fire.

(b) Errors due to irregularities in the matériel.

Under the first heading we will find errors committed by those charged with observing, serving, and correcting the fire of the guns, all errors which may be caused by an infinite number of conditions. Intelligence, unflagging zeal, experience, and constant practice will reduce them to a minimum. The frequently concealed and protected position of the gun itself, its shield and its distance from the firing line tend to reduce excitement and nervousness among the cannoneers to a minimum but this condition among the operators has little effect upon the gun itself on account of its fixed support. A high order of fire discipline, a condition resulting from constant training and practice should insure an orderly and efficient service of the piece in the delivery of fire, under even the most adverse condition.

With the full complement of officers and enlisted men in the firing battery, the checks upon the laying are such that errors are few and far between with well instructed personnel.

Under the second heading, the error due to the gun itself is negligible and it will stand at least 2000 rounds before passing its accuracy life. The principal irregularities due to matériel will be found in the projectiles themselves and many of them are practically impossible of correction, but, due to well drawn specifications and careful inspection, they have been reduced to a minimum.

As firing over the heads of friendly troops is to be regarded as a normal procedure, the following may be said of this matter:

With well instructed personnel the checks on the laying are such that an error in this respect is of rare occurrence. A defective shrapnel is very unusual. By the time the infantry lines are close in on the enemy, the friendly artillery should have a very close adjustment and will probably no longer be under any hostile fire itself, thus removing many of the chief causes of inaccuracy. The following is an example of what can be done under normal conditions:

On November 8, 1910, the regimental commander of the Sixth Field Artillery conducted the fire of his regiment against a line of trenches represented by 490 kneeling figures at a range of 2,200 yards. It was supposed that friendly infantry was advancing against the trenches, hence there were three lines of standing and kneeling figures at 100 yards, 200 yards, and 300 yards from the enemy's trenches. There were 320 figures in the friendly lines. The ammunition used was common shrapnel, fused with the model of 1907 fuse. In the enemy's trenches 358 out of 490 figures were hit—an average of 73 per cent. In the advancing infantry only 3 figures were hit—all on left of line nearest target. In all there were 140 rounds fired.

Volume of Fire: Losses among the cannoneers has little effect upon the volume or rate of fire. As long as one man remains at a gun the piece can and should be served and its rate of fire even under these conditions is comparatively high. Historical examples of service of field guns up to the last moment are numerous. The loss of guns so served should be no reflection upon their personnel. When the guns are defiladed from the target and are consequently using indirect fire methods, the destruction of the personnel at the important observing stations will usually stop the fire until they can be replaced.

CHAPTER VII

HEAVY FIELD ARTILLERY

Until comparatively recent times armies fought almost entirely in the open. All that was required of mobile artillery then was a gun capable of demolishing buildings and walls, damaging the enemy's matériel, and of attacking his combatant troops. (A gun for this purpose has been gradually evolved in all armies. Our 3" field piece and our 3" howitzer may be taken as a standard type of such a piece of ordnance the world over.) Field fortifications then were rarely encountered or, if so encountered were of a very inferior type, and no necessity existed for a gun habitually with the mobile troops powerful enough to breach strong entrenchments. Entrenchments beyond the power of the light field gun were rarely encountered. It is true that fortified places existed from time immemorial and such fortified places have been subject to attack since the dawn of ages, but the existence of these places was known beforehand to the attackers; they were permanent works and did not spring up in a night, the work of a moving field army, and consequently there was no need for heavy guns until the time of the investment of such places approached, and when that time did arrive, heavy ordnance, from storage or from the attackers own fortified places could be brought up and the siege or reduction of the place commenced. With the advent and development of hasty entrenchments and other extemporized cover by armies moving in the field the necessity very quickly arose for a heavy gun, a gun more powerful than the gun ordinarily marching with the moving troops.

Thus was begun the contest between "cover" which it was possible for troops to construct in the field and ordnance capable of breaching it. The power of the light field piece, due to the progress of the science of ordnance and gunnery, has increased, and at the present day this light gun has some breaching ability, but as a matter of fact, the quantity of explosive contained in the 3" shell is so small that its demolition effect is very local and extremely small; and it is a recognized

principle that if troops have 24 hours in which to dig and know how to dig they can produce cover beyond the power of the present 8.0 inch gun. The problem then has been to produce a field piece which would have the power to breach any work that could be constructed by troops in the field and in view of the fact that defensive works may spring up in a night and be constantly strengthened in the succeeding days, not only was a weapon of this power needed, but one which was sufficiently mobile to keep up with the infantry masses and be at hand at the moment it was required. The leisurely bringing up of heavy guns from forts or from storage in the rear is too slow a process in such cases, and thus has grown up "the heavy field artillery" of a modern army. And the term "heavy field artillery" may be defined as ordnance (guns and howitzers) heavier than the 8" gun, capable of breaking through any cover that troops in the field may construct and sufficiently mobile for active association in the normal operations of a field army and suitable to attach to an infantry division.

In the United States and England there has been some confusion as to the classification, due to a confusion of the terms "Siege Artillery" and "Heavy Field Artillery." In separating the field artillery from the coast artillery in 1907 Congress decreed that "the Field Artillery" is the artillery which accompanies an army in the field and includes light artillery, horse artillery, siege artillery, and mountain artillery," thus uniting under one caption all of the varieties of mobile artillery, at that time in our service. It will be noted that the term "heavy field artillery" is not mentioned in the act, but that the term "siege artillery" is used. This was due to the fact that at that time we had in service as a part of our mobile army, batteries of 5" siege guns and 7" howitzers. These pieces had long been known as "siege artillery" and dated back to a time prior to the development of heavy field artillery, and consequently as it was intended that the Field Artillery should include all mobile artillery, the designation "siege" was put into the law.

It should also be noted that the significance of the word "field" is here considerably extended and is made general instead

of referring to a special class of artillery. When "field artillery" is spoken of abroad, that artillery armed with the 8 inch, or 7.5 mm gun, is usually meant; in other words it is a specific class, whereas with us the term is a general one including a number of varieties including heavy field artillery.

The confusion in the terms "heavy" and "siege" is also due largely to the fact that heavy field artillery is a product of the last ten or fifteen years, while siege artillery is a very old designation.

The birth and growth of this practically new arm has not done away with siege artillery. When the field army confronts permanent or semi-permanent works and a siege is inevitable, then we must bring up from storage or from our own fortifications the heaviest ordnance that we can transport and *all artillery* attacking the place, from the light mountain howitzers to the 12" sea-coast mortar if we can get it up, can then be designated as *siege artillery*.

Therefore, while we have mountain artillery, light artillery, horse artillery, heavy artillery, and sea-coast artillery, we have no such thing as *siege artillery*, per se, except the old style pieces, but any or all of the above classes may become *siege artillery* when put in place to reduce permanent or semi-permanent works. The heavy artillery accompanies the army at all times, is used to support the infantry attack on fortifications beyond the power of the light field gun, and to neutralize the heavy field artillery of the enemy; it takes up the work where the light field gun leaves off and is a necessary part and parcel of the mobile army.

On the other hand it may be understood that siege artillery (in our service) comprises guns, howitzers, and mortars that are not necessarily permanently horsed, and which do not accompany an army but are brought up when needed for some specific purpose, by utilization of traction engines, railroads, motors, or other means of moving the guns—and that platforms, wooden or concrete, are built, and that when the guns are placed in position they generally stay there until the siege is over.

In European armies this class of artillery is served by fortress artillerymen, a class that we do not have in the United States.

The Continental nations having a land frontier have constructed defensive works along the frontier which are armed with guns heavier than field guns and lighter than our large sea-coast guns and these are served by fortress artillerymen.

When these men are no longer needed in the fortress they move out and take with them such ordnance as can be transported. These fortress troops are an intermediate class between our Field Artillery and our Coast Artillery.

No provision has been made in this country for this class of troops. Nor has it been definitely settled who shall handle such guns if they are especially provided but it is very probable that in the absence of any specially devised gun for siege work the coast artillery will be called on to handle such of their own ordnance as can be transported to the scene of a siege and such other heavy ordnance as the old siege howitzers and guns which are still capable of effective work in such warfare. That such a course is contemplated is indicated by the fact that some of the old siege ordnance has been turned over to the coast artillery.

To revert to heavy field artillery proper it will be seen that its origin and development is the logical outcome of the development of field fortifications and of infantry tactics. It is slow moving and due to its decreased mobility it is more vulnerable than the light field guns on the march and in action. Its ammunition is costly and heavy, but the necessity that created and developed it continues to exist and it has become an integral part of the mobile armies of all nations. The reports of the Balkan war indicate an extensive use of the heavy field artillery and create the impression that more of it would have been very desirable. It appears to have been particularly invaluable in several instances in *covering the deployment of the light field guns which could not get into position without its assistance.*

The present European war has further demonstrated the absolute necessity of heavy field artillery where the trench con-

structions have approached the nature of permanent fortifications. The cry has been not only for guns and more guns but for the largest calibres possible.

CHAPTER VIII

ORGANIZATION

THE SECTION

A *gun section* consists of a gun and its caisson manned, horsed, and equipped.

A *caisson section* consists of two caissons manned, horsed, and equipped.

The leading caisson of each caisson section in the normal order in park is called the *first caisson*; the other is called the *second caisson*.

THE BATTERY

On a war footing the battery is organized in nine sections.

The first, second, third, and fourth sections are gun sections.

The fifth, sixth, seventh, and eighth sections are caisson sections.

The ninth section comprises the battery wagon, the store wagon, and the allotted field wagons.

The first and second sections constitute the first platoon. It is commanded, when limbered, by the senior lieutenant.

The third and fourth sections constitute the second platoon. It is commanded, when limbered, by the lieutenant second in rank.

The fifth and sixth sections constitute the third platoon. It is commanded, when limbered, by the lieutenant third in rank (Note: This platoon is broken up on forming for action.)

The seventh and eighth sections constitute the fourth platoon. It is commanded, when limbered, by the lieutenant fourth in rank.

The ninth section is commanded by the quartermaster sergeant.

On subdivision for action the battery is divided into the *firing battery*, the *combat train*, and the *field train*.

The *firing battery* comprises the first five sections. It is under the immediate command of the captain.

Upon unlimbering, one lieutenant, called the *executive*, takes immediate command at the guns. He is assisted by another lieutenant, called the *assistant to the executive*.

The *combat train* comprises the sixth, seventh, and eighth sections, the battery wagon, the store wagon, the reserve men, and at least one pair of harnessed wheel horses and one pair of harnessed lead horses. Upon subdivision for action, it is commanded by a lieutenant, who is assisted by the stable sergeant.

The fourth lieutenant of the battery is the *battery reconnaissance officer*. The battery lieutenants are assigned to their duties irrespective of rank and according to ability.

The *field train* comprises the allotted field wagons and such personnel as may be directed to accompany them. It is commanded by the supply sergeant.

On a peace footing the seventh and eighth sections are not manned or horsed. With this exception, the personnel, animals, and matériel allowed on a peace footing are organized as prescribed for a war footing, the captain making such assignments as may be necessary to replace personnel and animals not authorized on a peace footing.

There has been much discussion as to what number of guns should constitute a battery. Should a battery be composed of three, four, six, or eight guns? A few basic principles govern a decision in this matter and of these, adjustment of fire is one of the most important. One axiom of the profession is that, "the time from first round to effective fire should be a minimum," and this would tend to reduce the number of pieces in a battery, on the other hand, "one gun is no gun at all" which argues a large number of pieces in the battery. In general a "battery" should be large enough to utilize efficiently the properties of fire of the pieces of which it is composed. If it is smaller than this, the organization fails in economy. Furthermore the tendency will then be to utilize two or more such units in combination. If it is too large a part of its energy will be dissipated

or not made use of. It must be remembered that each little unit must be provided with an organization for its interior economy and with an organization for the control of its fire and its tactical handling. There are also limits to the ability of any one man, the captain. Considering that one of our light field batteries at war strength contains eighteen carriages not counting the four or more field wagons, has a personnel of some one hundred and eighty men and one hundred and sixty animals with property amounting to more than \$100,000 it will be readily seen that the limit has been about reached in the amount of matériel and personnel one man can coördinate. Granting that a part of this supervision could be assigned to assistants we come again to the heart of the proposition when we consider whether or not one man can handle and efficiently direct the fire of more than four pieces. It is possible that with long training this could be done, but at the outbreak of war we shall not have time to instruct all our militia captains in this duty and the ordinary consensus of opinion is that four guns is about the limit of the average man and those nations who have adopted batteries larger than four guns have done so in the face of much opposition and were influenced undoubtedly by the financial rather than the tactical conditions. The question of ammunition supply also enters into the problem. The necessary extra caissons for a six gun battery produce a very unwieldy organization.

THE BATTALION

A Battalion of field artillery consists of three batteries* of field artillery and of the authorized staff and noncommissioned staff. It is ordinarily commanded by a major.

The field, staff, noncommissioned staff, etc., of a battalion are as follows:

* Two batteries in the heavy artillery.

WAR FOOTING

Personnel	Number.	Remarks.
Major	1	Commands battalion.
Captain	1	Adjutant and reconnaissance officer.
Battalion sergeant major....	1	Assistant to adjutant and reconnaissance officer.
Sergeant	1	Agent with regimental commander.
Corporals	5	8 scouts, 1 signaler and telephone operator at battalion headquarters, 1 instrument operator.
Bugler	1	Bugler and orderly.
Privates	9	4 scouts, 1 assistant to signal corporal, 2 drivers for reel cart, and 2 orderlies and horse holders.

All the personnel are individually mounted except the drivers and the assistant to the signal corporal (reel-cart operator) and belong to the Headquarters Company.

It will be noted that the battalion adjutants have the rank of *captain*. This is very necessary in the field as these officers are the battalion reconnaissance officers and the proper performance of their duties requires previous experience as battery commanders and judgment and skill that may be acquired only by long service and practice.

THE REGIMENT

A regiment of field artillery consists of two battalions,* and of the authorized staff, noncommissioned staff, and band. It is commanded by a colonel.

* Three battalions in the heavy artillery.

WAR FOOTING

Personnel.	Num-ber.	Remarks.
Colonel	1	Commands regiment.
Lieutenant colonel	1	Such duties as may be assigned him by the colonel.
Captains	8	1 adjutant and reconnaissance officer, 1 quartermaster, 1 commissary.
Chaplain	1	
Veterinarians	2	
Sergeant major	1	Assistant to adjutant and reconnaissance officer.
Color sergeants	2	
Sergeant bugler	1	Orderly and bugler for regimental commander.
Sergeants	2	1 in charge of scouts, 1 signaler and telephone operator at regimental headquarters.
Corporals	4	2 scouts, 1 instrument operator, 1 signal corporal.
Mechanics	5	2 horseshoers, 1 saddler, 2 mechanics
Privates	9	4 scouts, 1 assistant to signal sergeant, 2 drivers, and 2 orderlies and horseholders.
Bugler	1	Bugler and orderly.

All the personnel are individually mounted except the drivers and the assistant to the signal sergeant (reel-cart operator) and belong to the Headquarters Company.

THE BRIGADE

Under the present Field Service Regulations a brigade of field artillery consists of two regiments of field artillery as at present organized. The artillery brigade of an infantry division will be made up normally of 3-inch guns and 3.8-inch howitzers or 4.7-inch howitzers with 8-horse teams.

CHAPTER IX

FORMATIONS AND MANEUVERS

Simplicity is the keynote of the present field artillery drill.

Those who recall the rapid and complicated battery drills of fifteen years ago, may inquire the reason for the violent change. The drill then, was a product of civil war experience,

when the gun used was the direct fire piece of limited range. To be effective it had to go into action on or close to the infantry line. A firing line is anything but a stable formation and once there the battery had to accommodate itself to the many fluctuations of the infantry line, and rapid changes of front to the flanks or rear were necessary for the efficient working of the battery and frequently for its self preservation.

Also, concentration of fire at threatened points, could only be secured by concentration of guns at some point, and sudden, rapid movements were absolutely necessary as a part of the drill and instruction.

With the modern piece, its presence on the infantry firing line is neither necessary nor often advisable, and concentration of fire may be obtained without concentration of the firing units. The combat positions for modern quick fire field artillery are habitually previously reconnoitered and their occupation is ordinarily effected in a methodical and deliberate manner.

The firing unit no longer as a rule accompanies the infantry advance *bodily*, but rather *by its fire*—changes of position are the exception rather than the rule and concentration of fire is effected by manipulation of the sheaf of fire rather than by a movement of the guns.

Consequently the drill has been denuded of the old necessarily spectacular and complicated movements and there remain only a few simple evolutions which answer all practical purposes for the new matériel.

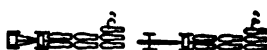
In the service of the piece, the mechanical appliances have so reduced the number of cannoneers that there no longer remains any necessity for a "service by the numbers" to prevent interference among the men serving the piece and while in the present drill, specific duties are assigned to the various members of a gun detachment, the details of their execution is not rigorously prescribed.



FLANK COLUMN



DOUBLE SECTION



SECTION COLUMN

FIG. 2.

THE SECTION

The Section is the basic drill unit. Limbered up it has three formations: (See Fig. 2) *Section Column*, in which one carriage is in column behind the other; *Double Section*, in which the two carriages are abreast of each other with an interval of two yards between wheels; *Flank Column*, in which the carriages are abreast of each other with an interval of seventeen yards between wheels. All movements of the section are limited to movements to the right, left, front, and rear when in any one of the above formations, to the oblique, to the passage of the rear carriage to a position in front of the other when in section column, and to movements necessary for passing from one of the above mentioned formations to any of the others. Limbering and unlimbering may be effected to the front or rear and unlimbering also to the right or left when in double section.

THE BATTERY

The Battery is an aggregation of sections and its prescribed formations are those resulting from having all of its sections in any one of the formations prescribed for a section.

The movements of a battery are limited to movements to the front, the oblique, by the flank, passage of carriages, closing and extending intervals between sections, passing from one prescribed formation of its sections to another, and movements of the carriages to the rear by an about or counter march. It unlimbers to the front or rear from the double section line and to the right or left from double section column. It limbers up, "front and rear" or to the rear. Chiefs of subdivisions give the necessary commands for avoiding obstacles encountered in maneuvering and for resuming the previous formation.

Before unlimbering the guns for action, the battery on a war footing is subdivided into firing battery, combat train, and field train.

To subdivide the battery and prepare it for action, the captain gives the appropriate command.

The carriages of the firing battery are at once prepared for action. Each chief of platoon inspects his unit and reports to the captain whether or not all parts of the matériel are in working order. The reconnaissance officer, the combat train commander, and the field train commander, if present, report to the captain for instructions.

This subdivision is ordinarily effected in rear of the position to be occupied. If the guns have to be moved a considerable distance or over rough ground to reach the position, the panoramic sights and range quadrants are replaced in their cases, and are again placed in their seats when the position is reached. As the guns are moved forward to their position, the combat train commander posts the combat train under cover in the general locality indicated by the captain; the quartermaster sergeant similarly posts the field train, if that train is present.

The first caisson of the fifth section is habitually unlimbered on the right of the line of guns, the second caisson on the left.

One or both of these fifth section caissons may be unlimbered in rear of the line under cover, depending upon the nature of the ground and the character of the action. If practicable, the captain uses the caisson on the windward flank as his observing station.

The limbers of the firing battery are posted by the first sergeant where directed by the captain. The first sergeant in action posts the limbers and remains in charge of them.

THE BATTALION

The movements of the battalion are covered in two short paragraphs—one section of which is as follows: The actual occupation of a position is not as a rule effected by a formal maneuver of the battalion as such, but rather by the separate movements of the individual batteries to the positions assigned them, to the end that all possible advantage may be taken of the cover and concealment afforded by the ground. Formal maneuvers of the battalion as such are consequently of limited application.

THE REGIMENT

The regiment has no formal maneuvers as such.

The Colonel causes his commands to be transmitted to the majors, and the latter maneuver their battalions according to the prescribed principles, so as to place them in the desired formation at the proper time and place.

FRONTAGES

In the normal unlimbered formation of the battery the interval between the carriage poles is 20 yards, giving a front of 100 yards for the battery.

The normal interval between the batteries of a battalion is 40 yards giving the normal battalion front of 380 yards.

The normal interval between battalions of a regiment is 80 yards. The front of a regiment unlimbered is therefore 840 yards or approximately one-half mile. These frontages may be easily calculated mentally by remembering the basic interval of 20 yards from pole to pole between sections, and that intervals

between any similar units are double the intervals between the next lower units.

The frontages may be considerably reduced by withdrawing one or both of the 5th section caissons in each battery to positions in rear of the battery, and still further reduced by putting in the guns at a less interval than the normal 20 yards. This is a common procedure when space is cramped, but is objectionable for several reasons: the firing of one piece disturbs the cannoneers of adjacent ones, limbering up is more difficult by reason of the teams interfering with each other, and the target presented to the enemy is more vulnerable.

It would not be unusual where ground is cramped and in cases where all three batteries will be called on to fire at the same target for the major to put in the battalion as a solid battery with the pieces at the normal or reduced intervals and fire it as such. This is not a good formation to be in, if fire by battery is to be taken up without change of formation, as the captains interfere with each other.

A battalion is the largest unit in which fire control would be exercised:

Gaits: The maneuvering walk is at the rate of 4 miles per hour; the maneuvering trot at 8 miles per hour and the maneuvering gallop at 12 miles per hour. The slow trot is from 6 to 6½ miles per hour. The gallop is prohibited in the heavy field artillery and authorized in the light, only in special circumstances.

CHAPTER X

INFORMATION SERVICE

This is put under three heads by the Drill Regulations.

The first is information which will favor the movement and employment of the guns. The primary source of this information must be from the troops the artillery is attached to, given to the artillery commander, by the commander of the troops. Hence the necessity of the artillery commander being with this commander until his duties take him away; in which

case he should leave a representative. In all cases this information must be supplemented by a reconnaissance made by the artillery personnel. For this purpose regimental, battalion and battery commanders have a reconnaissance officer and each of these organizations a certain number of scouts and agents who are trained for this duty. Ordinarily the organization commanders conduct this reconnaissance assisted by their reconnaissance officers and scouts, the agents being held for communication service.

The second subhead of the information service is that between the artillery commander and the commander of the troops the artillery subdivision is to support. This, the regulations state, should be inaugurated by a preliminary conference between the two commanders, and continued by signal corps lines or agents. At this conference the following should be definitely understood:

- (a) The plans of the infantry commander for carrying out his mission.
- (b) The location of the supporting artillery and of its commander and his plans for coopération.
- (c) The means of communication, methods, etc., for securing close coopération.

In special cases the field artillery telephone matériel may be used. In every case, however, an artillery agent should be present with the infantry commander, with one or more competent messengers to keep up the flow of information. There may be a strong temptation on the part of the infantry commander to use this artillery personnel for his own messenger or orderly service in time of stress. This should be avoided if possible.

As an example of the necessity for this class of communication, take the case of a battalion of field artillery supporting the attack of a brigade. It may happen that a part of the infantry line, say a battalion, becomes unable to gain any ground due, let us say, to machine gun fire from some point on the enemy's line. The non-advance of this battalion may be plainly evident to the field artillery but due to distance or a

flank position the artillery may be unable to locate the opposition. Here it is that the artillery agent is invaluable. By a hasty sketch or other technical means, he communicates promptly to his own commander the location of the hostile unit and the wishes of the infantry commander for fire on this point. The converse of this is also very true. It would be well if an infantry agent could join the headquarters of the supporting artillery at the beginning of a combat. Artillery headquarters will always detail an observer to follow the infantry advance with his glasses and be prepared at all times to point out the friendly elements to his chief. But it must be remembered that this man will be an artilleryman, his interests lie with the work of his own arm and however efficient and zealous he may be, he may be diverted from time to time by observing the work of his own arm and lose touch with some of his own infantry.

It would be better if his work could be taken over or supplemented by that of an infantryman trained for this work, whose interests would all lie with his own organization and whose movements he could better follow through intimate knowledge of its personnel. It is of the utmost importance that in the final stage of the assault the infantry commander should have a sure and rapid means for causing the artillery fire to be lifted from the hostile line, and the signal for this should be decided upon in the preliminary conference if possible.

The third branch of the information service is that maintained between the elements of the field artillery itself.

Each battalion and higher headquarters is provided with sufficient agents for linking its commander with the next lower unit of his command.

Each battery, each battalion and each regimental headquarters is provided with suitable signal and telephone apparatus.

The battery apparatus consists of three field telephones and one mile of buzzer wire carried on a breast or hand reel and paid out by a mounted man.

The battalion apparatus consists of two field telephones with one mile of buzzer wire and three miles of double conductor artillery cable on a reel cart.

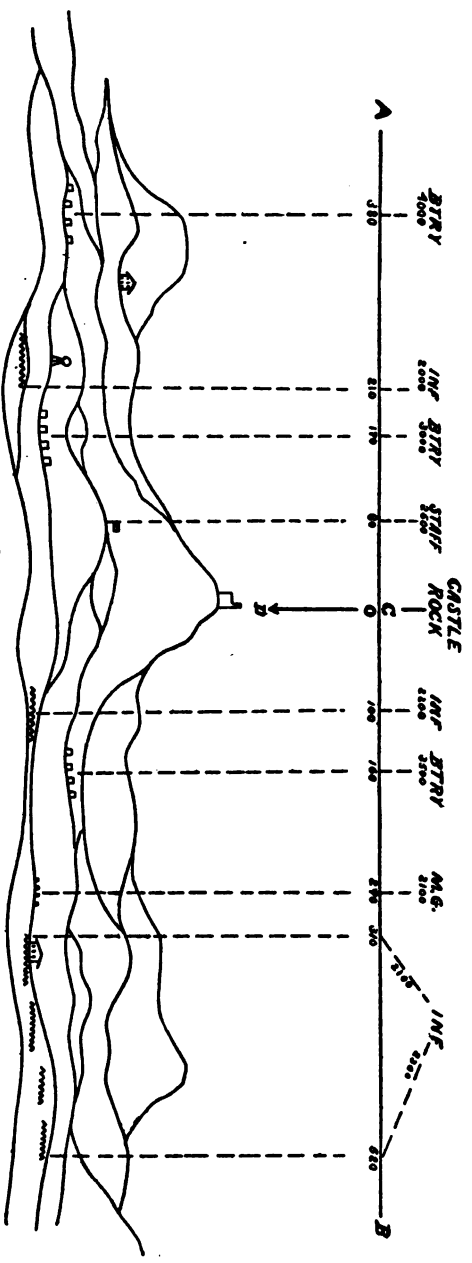


FIG. 3.
PANORAMIC SKETCH

N
X
KNOB HILL

9 Sept. 13 - 8:30 A.M.
John Jones
Corp. Bat. K, 9th F.A.

The regimental apparatus consists of two field telephones, one mile of buzzer wire and three miles of artillery cable on a reel cart. All three organizations are provided with semaphore outfits and all of the telephone personnel are instructed in visual signalling.

The battery apparatus connects up the various parts of the battery, the battalion apparatus, that of the battalion and the regimental apparatus that of the regiment.

The available matériel must be employed according to a flexible scheme, each case being solved according to its particular necessities.

No special apparatus or operators for signal or telephone communication are provided at artillery brigade headquarters. The means provided for regiments, battalions and batteries are, however, ample to permit connecting up all the parts of a field artillery brigade in the usual case.

PANORAMIC SKETCHES

These are very useful and simple sketches for indicating the location of targets. One of the duties of scouts and reconnaissance officers is to locate the hostile positions, particularly those targets which will first require attention such as batteries of field artillery and of machine guns, advanced positions, etc. These are frequently difficult to pick up and much valuable time would be lost if each subordinate commander upon arriving at his position had to inaugurate a study of the landscape in his sector. Also, these targets, once identified are frequently equally hard to relocate if their position is not recorded some way. The panoramic sketch seems to answer the above purposes very well. Artistic ability on the part of the sketcher is not necessary; it is easily taught to enlisted men and requires no paraphernalia except a small piece of paper and a pencil.

Referring to Figure 3, the sketcher draws the horizontal line AB, about an inch from the top edge of his proposed sketch and notes by a cross (X) his position, in this case Knob Hill. The arrow indicates the meridian. Avoiding all attempts at artistic effect, he rapidly sketches the most pronounced panoramic features in his front, generally, or if necessary exagger-

ating the vertical dimensions, selects a conspicuous object on the horizon as his "reference point" (in this case, Castle Rock) and labels it as such by a vertical line (CD) drawn through it and identified by an arrow at its lower end. This is his zero for angular measurements, right and left. He then proceeds to study the landscape in some systematic manner and records his targets as he picks them up by laying off their angular measurement from his reference point (obtained by the B.C. ruler or by hand-breadths) with some degree of accuracy and recording this angular measurement along the horizontal line AB. The ranges, estimated or measured, are noted along the top edge of the sketch with the designation of the target written over the range.

Such a sketch handed to an officer arriving on the line saves him much valuable time in coming to a correct estimate of the situation in his sector.

DESIGNATION OF OBJECTIVES

Inasmuch as an infantry attacking line may frequently wish to have artillery fire brought to bear upon certain hostile positions and formations it is thought well to insert these paragraphs on the designation of objectives taken from the F.A.D.R. for possible use in communicating with the artillery.

Objectives must be designated in a prompt, concise, and unmistakable manner. . . .

If targets are distinct and clearly defined, they may be designated by name, as, for example, "The battery on hill 240," "Cavalry to the right front," etc. If a target is indistinct, poorly defined, or masked, then an area may be designated for attack, the nature of the target being invariably given.

In designating objectives . . . the following procedure is appropriate, especially when the objective is not conspicuous or readily recognized:

Define the *relative position* of the objective by giving the approximate direction and distance of the objective and its location with respect to a prominent feature of the landscape as a *reference point*. Then give its important *characteristics*, such as its nature, shape, and color. Sometimes the *site* of an objective will simplify its designation.

A reference point should, if practicable, be within the sector assigned for attack, preferably near its center.

Directions may be indicated by pointing; by the use of military terms, such as *to our left front*; by the use of imaginary hour marks on an artificial horizontal clockface the center of which is at the position of the speaker, and the 12 o'clock mark directly to the front of the position or at a reference

point; by the similar use of a vertical clockface whose center is assumed to be at a reference point; by the points of the compass.

The location of an objective may sometimes be fixed by coördinates.

If the objective is in itself inconspicuous, it is usually best to designate first the most prominent object in its general direction, then to give the angular distance between this reference point and the real objective, and then to give the distance to and description of the latter.

The usual method of procedure is as follows:

1. Indicate the general direction of the objective.
2. Designate the most prominent object in the direction indicated.
3. State the angular distance from this auxiliary object to the objective.
4. Characterize the objective.

Thus:

1. At 2 o'clock horizontal.
2. At 3,000 yards a large stone house, square, two storied, with a cupola on top.
3. Five hundred mils to the right of the cupola.
4. At 2,500 yards a light battery in position in rear of the large orchard.

Or:

1. Northwest.
2. At 5,000 yards two symmetrical hills of the same height.
3. The left peak the reference point.
4. At 7 o'clock vertically, a field of brown weeds.
5. In that field, a machine-gun battery.

Or:

1. The lone tree on Artillery Ridge.
2. Two hundred yards south and four hundred yards west, a bare stretch of road.
3. Beyond the road, machine guns.

If it is necessary to designate objectives to a person at a distance, it is important to remember that objects often present very different appearances if viewed from widely separated positions. For this reason it is desirable to select as reference points natural features having geographical names, or objects having no similarity to others near by, or features having a uniform outline, and hence presenting the same appearance from whatever angle they are viewed. If a courier is used to transmit such information, he is required to keep the objective in view as much as possible while passing from one station to the other.

The designation of objectives may be greatly facilitated by the use of maps or by causing a position or place sketch of the terrain to be prepared and copies to be furnished the different subordinate commanders concerned. On such a sketch important landmarks and military objectives should be named or numbered for ready reference.

Panoramic sketches may be used in a similar manner, but when individuals using such a sketch for identification are widely separated, allowance must be made for difference in point of view.

Maps ruled into small rectangles that may be readily described by reference to horizontal and vertical notations on the margins are highly useful in the designation of objectives and areas. (F.A.D.R. Pars. 1144-1154)

CHAPTER XI

PREPARATION AND CONDUCT OF FIRE

UNITS OF MEASURE

The yard is the usual unit of distance. The unit angle is the mil.

The true mil is a thousandth part of a radian, or practically $\frac{1}{1570}$ part of a right angle; the mil adopted is $\frac{1}{1600}$ part of a right angle and is smaller than the true mil by approximately 4 seconds of arc.

Based upon the assumption that 6,400 mils equal 360 degrees, or 21,600

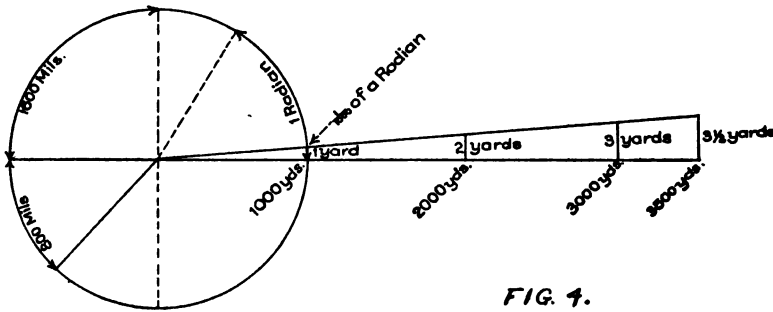
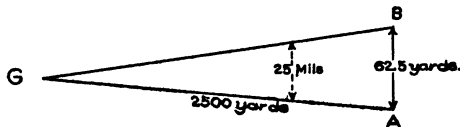


FIG. 1.



minutes, degrees may be converted into mils by first reducing the degrees to minutes and then multiplying by 0.3.

Example: The angle of departure $5^{\circ} 12'$, corresponding to a horizontal range of 3,000 yards, equals 312 minutes, or 93.6 mils. Actually, the angle in mils should be 92.4, which does not vary greatly from that given by the approximate method.

The converse of the above rule is true, and mils may be transformed into minutes by dividing by 0.3. (G. and E., Par. 40)

The mil is an exceedingly handy and sufficiently accurate unit of angular measure for all field artillery purposes. The half, quarter, eighth, etc., parts of the circle are expressed in terms of this unit, as 3200, 1600, 800, etc., mils, all of which are even hundreds and multiples of the handy factor "two." Its chief

advantage, however, lies in the ready calculation of the chord of any angle for a given radius. Thus, at 1000 yards an angle of 1 mil subtends a chord of 1 yard; at 2000 yards, of 2 yards; at 35000 yards, of $3\frac{1}{2}$ yards, etc. If the front of a target at 2500 yards range measures 25 mils, the target has a breadth of

$$25 \times \frac{2500}{1000} = 62.5 \text{ yards. (See Fig. 4.)}$$

Parallax (See Fig. 5) may be considered as another *unit of measure* in field artillery work. As used in this significance, the parallax of a point, T is taken to be *the angle, CTA, ex-*

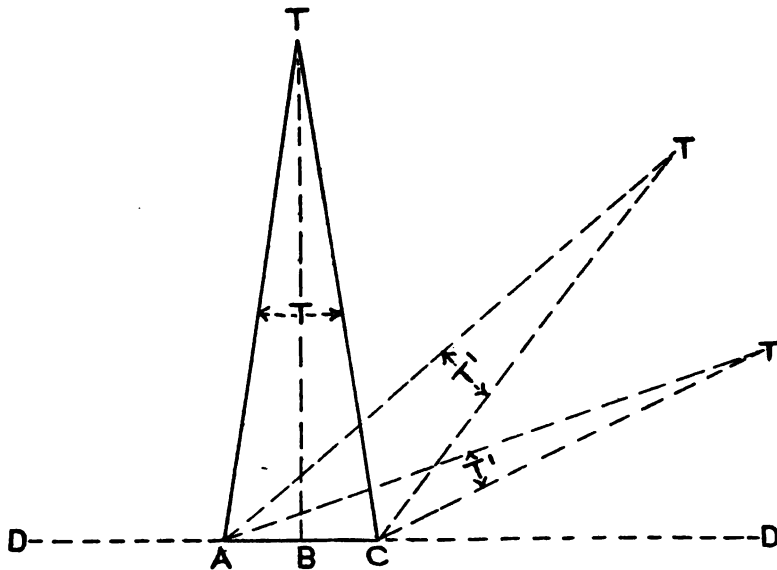


FIG. 5.

pressed in mils, subtended at the assumed point, T, by one platoon front, AC, (20 yards) at the position of the observer.

$$\text{Thus, the parallax of a target at 100 yards is } 20 \div \frac{1000}{1000} =$$

$$20, \text{ of a target at 6700 yards } 20 \div \frac{6700}{1000} = 2.9 \text{ or } 3, \text{ values}$$

being ordinarily taken to the nearest unit. This definition and use of the term conforms to its astronomical definition and use. For example, the parallax of the moon is the angle subtended at the moon by the earth's diameter. It will be noted that the parallax of a point has its maximum value when it is on the normal, BT, to the platoon front and decreases in value as it is moved right or left from the normal, to its minimum value (zero) when it is on the line of the platoon front, as at D. In all cases where parallax enters an equation its reduced value must be used if it is much off the normal. This is called the "correction due to obliquity" and is obtained by a rule of thumb or by reference to an "obliquity table." The use of parallax will be explained later.

Site: This is the angular elevation or depression (expressed in mils) of one point with respect to another. It generally refers to the angular elevation or depression of the target with respect to the gun.

LAYING

Laying is the process of pointing a gun for range and direction, so as to cause the trajectory to pass through the target. When shrapnel is the projectile to be fired, it also involves the correct setting of the fuse. There are two methods of laying: *Direct Laying* and *Indirect Laying*.

Direct Laying consists in bringing the line of sight upon the part of the target which the fire of the gun is intended to reach. In this case the gunner lays the gun for direction by means of the deflection scale of the panoramic or peep sight, and for range by means of the range scale. This method may be used when the gunner can clearly see through the sight the part of the target assigned to his gun. When direct laying is to be employed, the target is announced in the command, thus: Target, that blockhouse.

For direct laying, few, if any computations are necessary. The aiming point is the target itself and the deflection set off on the sight compensates for drift and wind. No correction for angle of site is necessary, due to the fact that the range is set off on the rear sight shank, after which the line of sight is directed upon the target. (G. and E. Par. 82)

To obtain the necessary distribution of fire of the guns of the battery, *Individual Distribution* is employed.

Individual Distribution is obtained by assigning to each gunner a definite part of the target to attack. Direct laying is always employed.

If the target has clear and well-defined limits, then the executives without special indication from the captain, assigns to each of his guns that portion of the target corresponding to its relative position in the battery. He indicates clearly to the gunner the part of the target on which he is to lay.

If the target has ill-defined limits, the captain first explains to the executives the exact front which the battery is to attack.

Indirect Laying consists in taking some well-marked aiming point, generally outside of the target, and setting off a deflection such that when the line of sight is brought upon the aiming point the gun will be properly directed upon the target. In this case the gunner lays for direction only, and No. 1 lays for range by means of the quadrant.

This method of laying is the rule in all cases where the gunner can not clearly see through the sights the part of the target which the fire of his gun is intended to reach. As quadrant elevation is used, the site of the target must be measured and set off on the quadrant.

When indirect laying is to be employed, the aiming point, and not the target, is announced in the command, thus: Aiming point, that white church steeple.

To obtain the necessary distribution of fire of all the guns of the battery, *Collective Distribution* is employed.

Collective Distribution is obtained by assigning a common aiming point to the pieces and giving them deflections which vary from right to left in regular progression. The fire may thus be distributed to any degree desired by the captain. Indirect laying is always employed.

The lines of fire of the several pieces thus collectively directed are called the sheaf of fire. By announcing the deflection of one piece and the deflection difference, the initial data for forming the sheaf are furnished. If no deflection difference is announced, all the pieces take the deflection which is announced.

The line of sight of each piece is then brought on the common aiming point.

It is thus seen that when indirect laying is employed it becomes necessary to determine the horizontal angle between the axis of each piece, properly directed upon its target, and the line joining each panoramic sight and the selected aiming point. The angle of site from gun to target must be determined and the guns must be located in such manner that their fire will clear the mask and otherwise conform to the nature of the particular problem. Firing data are determined at the observing station and there transformed for use at the guns.

Also, from the foregoing it will be observed that while direct laying is the normal procedure when the target is clearly visible to the gunners through their sights, and that indirect laying is obligatory when the target is *not clearly visible* to the gunners as when the battery is masked, that indirect laying is quite possible when the target is in plain view of the gunners and owing to the great rapidity and precision with which the sheaf of fire may be concentrated or opened out and shifted from point to point in the foreground particularly at long and medium ranges, by the methods of indirect laying and particularly because of the absolute one man control of the firing plant, many officers prefer and would use indirect laying even when the targets were quite visible to their gunners.

FIRING OVER A MASK

When a position for masked fire is to be occupied, it is necessary to make sure that the projectiles from each gun will clear the mask and reach ground which is occupied or is expected to be occupied by the enemy.

If the guns are already in position and the *mask is not more than 200 yards in front*, the guns may be given the elevation and site corresponding to the nearest expected position of the enemy, and a glance through the bores will tell whether the projectiles will clear the mask. At greater distances this method is not applicable because the trajectory is not a straight line.

In the general case clearance of the mask should be assured before the guns arrive, so as to preclude indecision and delay in posting them. It is necessary to decide what are the shortest range and the minimum site to be used. It can then be decided whether from the contemplated position of the guns the projectiles will clear the mask and reach the desired territory. If they will not, a place must be found from which they will.

To solve the problem the height in mills of the trajectory at the mask is determined and compared with the height of the mask in mills. (F.A.D.R. Pars. 1168-1170)

A sliding scale on the B. C. ruler is so constructed as to facilitate the solution of this problem.

In the problem of masked fire for horizontal ranges, the relation between the three variables is expressed by the following equation with a large factor of safety:

$$X = \frac{4Y}{R-X}$$

in which

X is the distance from gun to mask in *hundreds of yards*.

Y is the ordinate in *yards* corresponding to any point, X.

R is the range from gun to target, *in hundreds of yards*.

From this equation it is seen that the projectile will clear the mask when fired at a distance from the mask equal to four times the height of the mask in yards divided by the distance from mask to target in hundreds of yards.

Example: How close to a mask 5 yards high may the guns be placed to hit targets 1000 yards and over, beyond the mask?

$$4Y = 20$$

$$R-X = 10$$

whence $X = 2$ (hundreds of yards) = 200 yards.

Or the guns must not be closer to the mask than 200 yards to insure a dead space of not over 1000 yards.

If X and Y have definite values for any particular problem their value may be substituted in the above equation and the equation solved for the corresponding dead-space R-X. Similarly, if X and R-X have definite values in any particular problem these values may be substituted and the equation solved for Y, the maximum permissible height of mask.

CALCULATION OF THE ELEMENTS OF FIRE

Assuming now that the guns have been located in such a manner that their fire will clear the mask and otherwise satisfy the conditions of the particular problem, it remains for the captain to place himself where he can best observe the target or his

allotted sector of fire, to establish communication with the guns, and furnish them with the necessary firing data.

In the selection of his observing station he is usually limited, by orders, the nature of the terrain, and various other factors dependent on the particular case. Assuming the general case, that is, that the battery commander is on a flank and at some distance from his battery, Figure 6 may represent the general problem.

In this figure:

T is the target.

B, the observing station.

P, the aiming point.

G, one gun of the battery, called the "directing piece."

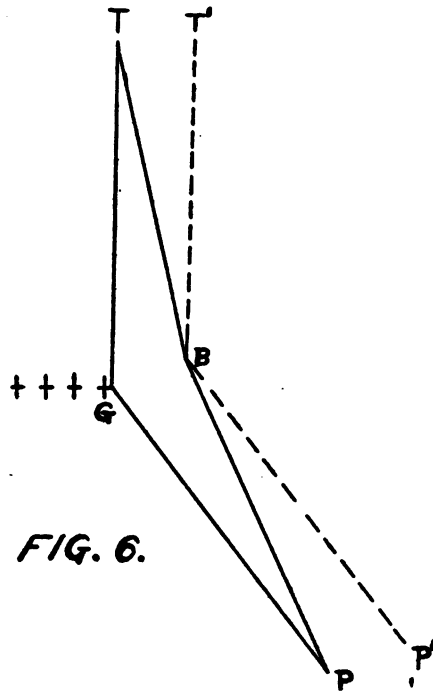


FIG. 6.

If the unknown angle $P G T$ is set off on the gun sight G and the sight directed on P which is visible to the gunner the gun

will point towards T. This figure will take various forms according to the relative positions of P and B which in particular cases may vary considerably, the two points sometimes coinciding. The problem is then to solve this figure for the unknown angle, P G T. The value of this angle is expressed by the following equation:

$$\text{Angle P G T} = \text{Angle A} \pm n (P - T)$$

In this equation A is the angle P B T in mils and is measured at B by the battery commander's telescope, the battery commander's ruler, or by hand-breadths.

P is the parallax of the aiming point, P (corrected for obliquity, if any), and is obtained by measurement or estimation of the distance B P. T is the parallax of the target, T (corrected for obliquity, if any), obtained by estimation or measurement of the distance B T.

n is the number of platoon fronts between B and G and is obtained by dividing the estimated or measured distance, B G, by 20.

If B is on the left of G, the factor n enters the equation with a negative sign, if on the right of G it enters with a positive sign. Similarly if P is in rear of the line of guns it enters the equation with a negative sign, if in front, with a positive sign.

Other manipulations of the equation and its known factors are necessary in special relative situations of battery, target, observing station and aiming point. An instrument known as the *plotter* is also furnished, by which the unknown angle P G T may be obtained mechanically. The results by either method are not absolutely accurate but are sufficiently correct to throw the first salvo within the field of view of the ordinary field glass which is all that is desired.

A more simple method known as the "parallel" or "graphic" method has lately been evolved in which the battery commander's telescope or the ruler is used as a calculating engine, thus doing away with the plus and minus signs which are always confusing, particularly to a beginner, in the mathematical solution. This method is as follows: (See Figure 6.)

From the known or estimated displacement, B G and the range to the target, at T, the angle T B T' is calculated mentally and laid off on the horizon giving the point T'. Similarly, the angle P B P' is calculated mentally from the displacement B G and the range to the aiming point at P is laid off on the horizon giving the point P'. Since T' B is thus parallel to T G and P' B is thus parallel to P G, the angle P' B T' is equal to the required angle P G T. The angle P' B T' can be actually measured with the instrument or ruler at B. In this process the calculator has only to get himself properly oriented and lay off these displacements in the proper direction. This method is readily picked up by intelligent enlisted men.

Convergence Difference. The captain therefore selects the most advantageous gun of his battery in any particular case as the *directing piece*, computes the deflection as above, and commands: *Deflection (so much)*. Each gunner sets his sight for the announced deflection; but it is manifest that if *all* the guns are laid with this deflection only one, the directing piece, is certain to point toward its proper point on the target and that a correction for this deflection of the directing piece must be applied for the other guns. Thus, it may be desirable that the fire of all four guns be converged on one point, that the fire be spread out over some appreciable frontage, or that the lines of fire of the four pieces be parallel.

If all the guns of a battery at normal or other equal intervals are, with zero deflection, laid accurately upon the same part of a target—for example, its right edge—and the lines of sight are then all directed upon a common aiming point, the deflection readings will be found to increase or decrease from right to left by a common difference. This common difference in deflection is termed the *convergence difference*. It is the deflection difference necessary to produce converging fire, being positive if the deflections increase from right to left, negative if they decrease. Its arithmetical value is obtained from the equation: convergence difference = P — T, in which P and T have the same values and the same signs as in computing the deflection of the directing piece. In other words, the convergence difference is

equal to the parallax of the aiming point diminished algebraically by the parallax of the target. It is additive if this algebraic difference is positive, subtractive if it is negative.

Thus, if the captain has selected No. 1 gun as his directing piece and has computed and announced the deflection, to converge the fire of all his guns, he simply computes the convergence difference as above explained, and commands: *On first piece, close (so much)*.

Distribution Difference. Assuming the guns to be still converged upon the right edge of the target, their fire may now be evenly distributed over the whole front of the target if we retain the same aiming point for all the pieces and the same deflection for the right piece but increase the deflection of each of the other pieces by an amount necessary to cause its line of fire to be directed upon its appropriate part of the target. The common difference in deflection necessary to effect this distribution is termed the *distribution difference*. Its value is obtained by dividing the front of the target, expressed in mils, by one less than the number of guns in the unit firing. It is always additive, provided the right gun is directed upon the right section of the target, and the difference is applied in arithmetical progression to the deflection of the right piece to determine the deflection of the other pieces in order from right to left.

Thus, if the guns are converged on the right element of a target whose front measures 30 mils, to distribute the fire over the front of this target, the captain commands: *On first piece, Open 10*.

Deflection Difference. The algebraic sum of the convergence difference and the distribution difference is the deflection difference. If converging fire is to be used, the distribution difference is zero and the deflection difference is therefore equal to the convergence difference.

Parallel Fire. This is a special case of distributed fire. If the lines of fire are parallel, they are directed upon points just a platoon front apart and it may be shown that the distribution difference in this case is equal to the parallax of the aiming point

which affords a quick and ready means of distributing fire, since to determine the deflection difference it is only necessary to estimate the range to the aiming point, compute its parallax, and announce that as the deflection difference. The sheaf may then be opened or closed an amount necessary to cover the particular target or the line of fire converged upon one point by opening or closing the sheaf by the estimated or measured amount at some subsequent adjusting salvo. Thus, the captain may command: *On third piece, Open (close) 10.*

The deflection of the directing piece and the deflection difference give the necessary parts of the gun laying data for the horizontal plane. The necessary components in the vertical plane are the *range*, and the *angle of site*, simply called *site*.

Range: The range, $G\ T$, is obtained by measurement, or by estimation or by comparison with the previously obtained distance, $B\ T$.

Site: To obtain this component of the data, the site of the target is measured from B and its difference in level with respect to B is computed in yards.

Similarly the site of the directing gun is obtained from B and its difference in level with respect to B is computed in yards. The algebraic difference of these differences in level is the difference in level (in yards) of the gun and the target. This is converted into angular measure (mils) and the result is the angular elevation or depression of the target with respect to the gun. To avoid negative values in gun laying data the figure 300 is arbitrarily taken as the zero site or a dead level, that is, site of 300 is a zero. The angular value of the depression or elevation of the target as just obtained added algebraically to 300 gives the site of the target with respect to the gun. Though seemingly complicated this computation is in reality very simply and can be quickly made, even mentally, with a little practice. The process is also expressed in a simple equation for use by those not so adept.

In open country, a distant horizon has site of 300. Hence the site of the target may be quickly obtained by direct measurement of its angular elevation or depression with respect to the general horizon.

The principles of gunnery show that the algebraic sum of the angle of elevation for a target at any particular range and the site of that target is the proper elevation of the piece with respect to the horizontal, to cause the trajectory to pass through the target. The range quadrant has two scales, one in yards, upon which the operator sets off the range, and the other in mils upon which he sets off the site. The quadrant is so constructed that when in place on the gun and the gun is elevated or depressed until the level bubble on the quadrant is centered, this algebraic addition is automatically made and the gun thereby has its proper "elevation" (inclination to the horizontal plane) for the particular target.

Setting the Fuse: When shrapnel is fired in time fire the fuse must be set so that it will cause a burst at the proper point in the trajectory. For this purpose a fixed fuse setter is provided on the caisson and a hand fuse setter for emergencies. The fuse setter is provided with a scale reading yards of range which is quickly set to the given range. The nose of the shrapnel is inserted in the fuse setter and the shrapnel turned until it brings up against a stop. This is caused by a lug on the time ring of the shrapnel engaging in a recess in the fuse setter. The result is, that the time train or fuse of the shrapnel is "cut" to cause a burst suitable for the given range. To provide for proper adjustment of the height of burst, the fuse setter is provided with a *corrector scale* which is graduated in numerals above and below an arbitrary normal and by the proper manipulation of which the fuse is so "cut" as to raise or lower the point of burst without disturbing the laying in range or site.

For indirect fire therefore the following data must be given to the guns, and the following is the prescribed order:

1. The designation of the aiming point.
2. The deflection.
3. The deflection difference.
4. The site.
5. The kind of projectile (corrector, shell, or precussion shrapnel).
6. The method of fire.

7. The range.
8. The command, by the executive, *fire*.

The necessary data for direct laying in their habitual sequence are—

1. The designation of the target.
2. The deflection.
3. The kind of projectile (corrector, shell, or percussion).
4. The method of fire.
5. The range.
6. The command, by the executive, *fire*.

Adjustment of Fire: The method of fire of field artillery differs radically from coast artillery. The field artilleryman is not provided with and has no use for the various elaborate and delicately adjusted instruments designed to measure and calculate the multitude of factors which have a disturbing effect on the flight of his projectiles, and which are essential for absolutely correct initial laying of the guns. They cannot be carried in the field and if they could be, there would rarely be time or opportunity for their use. The result is, that the field artilleryman's preliminary calculations are at the best very rough. His sole idea is to get his first salvo within the field of view of his glasses or easy measuring distance of his target, to accurately sense the result of this fire and to group all the errors committed in the primary laying into a few quickly but accurately measured corrections. These applied to his original calculations, sweep the latter out of existence and he has no further thought of them or use for them. For this reason the first salvo from a field battery will rarely if ever be a "hit," and experience has shown that if a "hit" be sensed at the first salvo it is ever a dangerous proceeding to accept it as such and pass to fire for effect.

Therefore when his guns are fired the battery commander must "sense" the effect, measure the errors, and announce the adjusting elements. The first of these errors is *range*. He must sense whether he is "over" or "short" and so far as *range* is concerned he must ordinarily repeat his fire without material change of range until he is certain that he is surely "short" or

surely "over." Certain of this, he must on his next salvo increase or diminish his range until he is certain that the opposite is true. He thus encloses his target in a range bracket whose maximum and minimum limits he knows.

By succeeding salvos, usually fired so as to "halve" the bracket he reduces this bracket to the minimum permissible for the target, which fix his range limits in his fire for effect.

The second error is that of *deflection*, or the error right or left of the target. This is measured with the battery commander's telescope, the battery commander's ruler or by hand-breadths and applied to the original deflection by a command to add or subtract so many mils (to the originally announced deflection), expressed thus: *Right (left), 100*.

The third error is that of *height of burst* which is measured by the means above mentioned or estimated and applied by a command "up" (so much) "down" (so much) and results in the corrector being increased or diminished by the amount specified. Raising the corrector, shortens the time of burning of the fuse and thus pulls the point of burst back along the trajectory and raises it; lowering the corrector, accomplishes the reverse.

The fourth error is in the deflection difference which is usually estimated and the correction applied by commands to "open" or "close" so much.

Errors in the site generally manifest themselves in abnormal point of burst and are usually wiped out by the judicious manipulation of the corrector, but when excessive, must be corrected by changing the site itself. While the computation of the preliminary data and the sensing and adjustment of fire seem complicated, the process proceeds logically in sequence and by "skill proceeding from study, thoughtful assimilation of the fundamentals, and above all from experience" the total time may and has been reduced to a very few minutes by many field artillery officers. It is an axiom of the profession that **THE TIME FROM FIRST ROUND TO EFFECTIVE SHRAPNEL FIRE SHOULD BE A MINIMUM.**

To Change Target: Adjustment having been secured and the sheaf formed for any particular target, the sheaf may be

rapidly, almost instantaneously, opened up or closed in by the command to "open" or "close" so much and the area about the target searched, by volleys at various ranges. The sheaf may be switched to a new target by measuring the angular interval to the new target, right or left from the old target, with the battery commander's instrument or ruler or by hand-breadths and announcing "right" (so much) or "left" (so much) by which each gunner decreases or increases his deflection by the specified number of mils, which throws the sheaf bodily on the new target. If the new target has a different range, the new range must be announced, and possibly several salvos fired to secure definite adjustment.

Methods of Fire: The methods of fire are by salvo, volley fire, volley-fire sweeping, and fire at will. The use of salvos and volleys is habitual and both natures of fire are ordinarily used in firing at each target, particularly in time fire. Volley-fire sweeping is employed during fire for effect. Fire at will is exceptional, being used only for the close defense of the guns. Salvos may be either by battery or by platoon. The pieces of the battery or platoon are fired in regular order from right to left or vice versa at intervals of about two seconds. In volley fire each piece fires the designated number of rounds as rapidly as possible consistent with accuracy and without regard to the other pieces.

The purpose of sweeping is to distribute the fire over a wide front. It consists in changing the direction of each piece between shots.

This may be accomplished mechanically by a full turn of the traversing handwheel between rounds if there is not material lost motion in the mechanism. Or, if the reticule of the panoramic sight is provided with a horizontal scale, the line of sight may be shifted through an appropriate angle.

Fire at will is for the close defense of the guns. Shrapnel only are used, with the sights and fuze so set that canister effect is produced. Each gun is fired as rapidly as possible, the gunner neglecting all refinements of laying, rapidity being of more importance than great accuracy.

"Barrier" or "Curtain" fire, used so much abroad, consists in building up a curtain of sustained fire along a designated front, generally within the hostile lines, to prevent movements of hostile troops or supplies between his front and rear lines. It may be inaugurated with our methods of fire by forming an open sheaf of fire and opening volley fire with or without sweeping.

Moving Targets: Direct laying is the rule, but in the attack of large moving targets indirect laying may be employed. In both cases the pieces are set ahead in range or deflection or both, the estimated or computed amount of the travel, and fire delivered at the proper moment. As targets will ordinarily remain exposed to view in the open but a short period of time, great skill in serving the piece and a high order of fire discipline are required to attain quick and effective fire upon such targets.

Fire for effect may be at a *single range* or at *successive ranges*. The latter is sometimes called *searching fire*.

Fire at a single range is appropriate in the case of a fixed target only, when it has little depth and adjustment has been definitely determined by previous fire. In the case of a moving target, fire at a single range may be opened when the target reaches a position upon which fire has been previously adjusted. If adjustment has been secured this method of fire produces effect with a minimum expenditure of ammunition.

Fire at successive ranges ("walk through") is appropriate in the case of fixed targets when they have great depth or when due to difficulties in observation their exact depth limits cannot be determined. In these cases the target is enclosed within a bracket of the smallest possible limits that can be determined with surety and reasonable promptness and the depth covered by volleys with successive increment or decrement in the range. This method of fire naturally requires more ammunition to produce a given effect than fire at single range but its employment will be frequently compelled, particularly at the long ranges and in cases where the observations of flank observers are ineffective.

The Drop-Back: In all range adjustments the target must be bracketed with a sure *over* and a sure *short*. In securing this range adjustment the battery commander is usually limited to his "sense" of the point of burst. The *effect* of the shrapnel is all *forward* of this point of burst. It may therefore frequently happen that while a *burst*, particularly air bursts, may be definitely sensed as short of the target and actually be *short* of the target this burst is so very little short of the target that the shrapnel *effect* is entirely over or beyond the target. Therefore, under certain conditions of target and certain conditions of sensing of shorts, it is well not to start fire for effect at the short limit as determined by the burst but to "drop back," 100 or more yards from this short limit and start the "walk through."

Observing the Terrain; Sectors of Observation: In preparation for definite and imminent phases of an action, certain bodies of artillery may be ordered to *observe* the enemy in designated portions of the terrain and be ready to bring him under immediately effective fire.

If possible, the position of the enemy is clearly pointed out; but if his exact position within a certain area has not been determined the area may be divided up into sectors and a sector assigned to each important group of artillery. In the former case the firing data are determined for the known position of the enemy; in the latter case, for prominent features of the terrain within the sector assigned.

With a view to gaining readiness for instant action, the guns may be laid upon the target or upon some selected feature of the terrain and the sheaf formed so as to provide for the desired distribution. When the tactical situation permits, units in observation may verify and correct their firing data by firing upon objects in their sectors, but only upon orders from superior authority. This is called "fire for registration."

Application of Fire: In service the fire of field artillery must be adapted to meet the requirements of many and ever-varying conditions. An infinite variety of concrete problems is af-

forded, and each problem will have its own best solution. Therefore great flexibility in the employment of fire is called for.

The drill regulations set forth principles which are the basis of action and rules which may serve as guides in the average case but they do not stand as cut and dried solutions.

The kinds of fire and methods of fire have been previously described. The following will give some idea of their application.

Percussion Fire is principally employed for the destruction of material objects, such as walls, building, obstacles, artillery matériel, etc. Such fire is termed *fire for demolition* and an accurate adjustment is necessary.

Time (shrapnel) Fire is employed for the attack of animate objects; the nature of the target, conditions affecting observation of fire and the time limit permitted by the conditions of the problem determine the degree of adjustment.

Volleys either *with* or without *sweeping* or *salvos* at successive ranges may be employed to search an area to any desired depth.

Volley Fire is adapted to the attack of personnel that are more or less vulnerable. It is an extremely flexible form of fire. The number of rounds to be fired in each volley and whether with or without sweeping, the number of volleys, and their range difference, if any, are all in the hands of the commander, and the sheaf of fire may be switched from point to point and opened out or closed in as the occasion may require. In the hands of a skillful officer it is economical of ammunition and by suitable bursts of fire is designed to meet the crisis of an action.

Salvos as previously mentioned are designed principally for use in securing adjustment, but may be employed in fire for effect with the idea of securing greater adjustment.

Fire at Will is employed solely for the close defense of the guns.

Against a slowly moving enemy, such as infantry, the fire should be commenced when he has arrived within about 350 yards of the gun; against a rapidly moving enemy, such as cavalry, when he has arrived within about 800 yards; the pur-

pose in both cases being to surely establish a fire-swept zone through which the enemy must pass in order to reach the guns.

Against infantry in position and more or less protected by entrenchments the artillery told off to support the infantry attack will attempt to secure careful adjustment. Its fire thereafter will be regulated by the necessities of the case.

The *amount* of preliminary artillery fire is regulated strictly by the necessities of the case. Frequently a continuous bombardment day and night for several days against his front lines may be necessary before it is possible to launch infantry against a well intrenched enemy with any chance of success.

This bombardment has for its object, destruction of his shelter and of obstacles to the advance, such as wire entanglements, the obliteration of his machine gun defense and the breaking down of his morale by casualties and lack of rest and supplies. In the meantime a curtain of fire must be maintained in his rear to prevent supplies, reinforcements or other relief reaching the front line. When the infantry attack is launched, this blast against the front line should be maintained until the advance of the friendly infantry renders its continuance dangerous; but the barrier fire in the rear must be maintained, ordinarily, until the friendly troops are firmly established in the hostile front lines. During this period, guns not engaged in the curtain fire must be held in observation for use against hostile formations advancing for a counter attack.

In open field warfare there can be little or no advance of the friendly infantry until fire superiority is attained and this must be the object kept constantly in view. The intensity of fire undoubtedly will increase as the infantry closes on the hostile lines and at times when the enemy's attempts at activity reach their maximum and should "culminate in a tremendous blast, more powerful than anything yet experienced, just at the supreme moment when the infantry are thinking more of their bayonets than of their cartridges."

Slow moving targets such as infantry in motion and mounted troops impeded in their march will be attacked usually by quickly bracketing them and searching the bracket. The pro-

cedure is the same in the case of rapidly moving targets except that the bracket must usually be made larger and volley fire opened ahead of the target, the sheaf being moved toward the target by successive volleys.

Against artillery in position the first object is to gain ascendancy over it by damaging its personnel and then attacking its matériel with shell fire.

Due to the difficulty, however, of reaching effectively the personnel of the batteries provided with shields and posted in masked positions, the struggle between evenly matched artilleries will often be long drawn out. If the enemy's artillery is temporarily overmatched, it may suspend its fire and shelter its personnel; but it must be expected to renew the struggle as soon as the pressure upon it is relieved.

Infantry moving to attack in deployed lines or in line of small columns may be met by volleys successively reduced in range as the infantry approaches. If their formation is in line of small columns, the fire should be distributed so that a piece or platoon may bear upon each of the small columns.

At close ranges infantry will probably endeavor to advance by successive rushes from cover to cover. Such rushes may be met by volleys previously prepared for upon selected positions, evidently in the immediate path of the enemy. If the positions occupied by important bodies of the enemy during the intervals of advance are well defined, accurately adjusted fire may be brought to bear upon such positions, and the ground between successive positions may be covered by searching fire when important movements of the enemy from one position to another are attempted.

CHAPTER XII

EMPLOYMENT OF ARTILLERY

GENERAL PRINCIPLES

The employment of field artillery in general depends upon certain general principles which should be familiar to officers of all arms. As enumerated by our drill books these principles

are: *Coöperation; unity of direction; utilization of force; certain preparatory dispositions and technical methods in the employment of fire, and economy in ammunition.* The exact method of its employment depends upon the particular tactical situation and the plan decided upon by the commander of the troops.

Coöperation: Page after page upon this subject is found in all standard works on modern field artillery and it is the subject of many articles in the technical periodicals. It is of such prime importance that it is treated later in a special chapter and is mentioned here simply in passing.

The field artillery is made to appreciate its importance; starting with paragraph one of the drill book which reads as follows: "The reason for the existence of field artillery is its ability to assist the other arms, especially the infantry, upon the field of battle," and this precept runs through the whole book. Coöperation requires mutual action and understanding and its importance especially to the infantry must not only be appreciated by that arm but the definite measures for securing it must be sought and practiced.

Unity of Direction: Whenever artillery is used, a decisive effect is usually intended and its influence is powerful in proportion to the timeliness with which it is brought to bear. To insure these two results there can be no division of command of the field artillery, its direction must rest entirely with its commander who must perforce be kept fully informed of the tactical situation and of the plans and intentions of the commander of the troops. This requires that the commander of the artillery personally accompany the commander of the troops during the march into action and during the preliminary reconnaissance.

* *A division is the smallest body of troops having artillery permanently assigned to it. The division commander controls his artillery through his senior artillery commander, giving him general instructions as to positions to be occupied and tasks to be performed, and holding him responsible for results secured.

To insure the coöperation of the Field Artillery with the other arms it is the duty of the senior Artillery commander to submit to the commander of the troops in ample time for appropriate action, recommendations concerning the position and use of the field Artillery of the command.

An officer charged with the accomplishment of a special mission, or one commanding an important sector of a battlefield, should, in general, have command of the artillery designated to cooperate in the tasks assigned him. Then it is necessary to detach bodies of artillery from their regular organizations for this purpose, it should be done by order of the superior commander only, who will make it clear to all concerned with whom the command of the detached artillery lies. When once detached, they are not returned to their proper organizations without similar authority. In emergencies, however, artillery finding itself in a given sector without definite instructions should at once report itself to the commander of that sector.

Unity of direction is favored by keeping the batteries, especially within the battalion, fairly close together. * * * * It is the rule to use field artillery in regiments or battalions. The employment of batteries singly is the exception, while the employment of smaller subdivisions is warranted only under the most exceptional circumstances.

While unity of direction, as a general principle, governs in the employment of field artillery, this does not remove or restrict the obligation imposed upon all officers to meet the sudden and unexpected emergencies of an action, when time does not admit of reference to the next higher authority. (F. A. D. R. Par. 1467)

Mass effect of artillery is of the same importance today that it was in the days of Napoleon, and is secured not so much by a concentration of matériel but by a concentration of fire which can be made a maximum only where there is perfect unity of direction.

Utilization of Force: It is a principle that all the guns should be placed in position at an early stage of the action. This does not mean that all are necessarily actually unlimbered but it does mean that all should be so located or so disposed that they can go promptly into position. And if the first steps toward unity of direction is thus secured, only so many are brought into action as are sufficient to dominate the situation from the outset and assure a prompt accomplishment of the task assigned to the field artillery. Superiority of fire is usually necessary to secure decisive results but it is important especially in the earlier stages of the engagement and particularly when on the defensive that the number and positions of the guns be not prematurely disclosed nor ammunition uselessly expended. Infantry or cavalry once committed to an action is generally beyond the control of the superior commander and the absolute necessity of retaining some reserve of these troops

always exists. Field artillery acting at longer ranges and frequently from concealed positions even though deployed and in action is not usually so completely out of the hands of the superior commander and may be withdrawn from action for use in other parts of the battle area or due to its long range may direct its fire upon other parts of the battle area without actual change of position. The necessity for withholding a reserve of this arm does not therefore exist. While it is essential that the superior commander should always have at his disposal batteries that can be utilized in emergencies, it is *not as a rule desirable to detail field artillery as a part of any general reserve. The true reserve of field artillery is its ammunition train.*

Preparatory Dispositions: An early disposition or deployment of the artillery is essential but premature commitment to action is to be avoided. On the other hand it must be available and ready for every duty as it arises. These conditions are best learned by posting artillery under cover in or near suitable concealed positions and making all preparations for meeting the probable phases of the action.

The commander of the troops should therefore in general, give the necessary orders for the deployment of the artillery and if necessary to prevent confusion with other troops specify the routes thereto bearing always in mind that artillery coming under effective hostile artillery fire when in column of route is artillery lost—to quote the Japanese "*Artillery seen, is artillery lost.*"

The superior artillery commander and his subordinates will then make the detailed disposition to carry out their mission somewhat as follows:

To facilitate the work of preparation, the duties assigned to artillery in observation or in readiness are made as definite as the conditions will permit. Thus, the terrain in which the enemy is expected to appear may be divided up into sectors and each sector may be assigned to a given group. Moreover, both in the preparatory and the later phases of an action special duties may be assigned to particular batteries.

For example:

1. To fire upon the hostile artillery. Such batteries are called *counter batteries*. * * * * * The term is distinctive of those batteries whose special function it is to combat the enemy's artillery.

2. To prepare and support the infantry attack. These batteries are called *infantry batteries* and include those assigned to the direct support of our infantry, assisting it by firing on the hostile infantry, by opening breaches in the enemy's lines, or by otherwise facilitating the advance. The infantry batteries are under the protection of the counter batteries, and include the so-called *batteries of preparation*, which fire on the opposing infantry, and the *breaching batteries*, whose mission is to open by their fire, passages in the enemy's lines through which our troops may advance.

3. To be prepared to meet a counter attack. Such batteries are called *batteries of the counter attack*. * * * *

4. To advance to the close support of the infantry attack. These batteries are called *accompanying batteries*. The term accompanying batteries must not be too narrowly interpreted as meaning an actual presence of the accompanying batteries on the infantry firing line, for in reality these batteries accompany with fire rather than by actual movements of the guns. Batteries may, however, be actually moved forward when by such forward movement a distinct and positive advantage will be obtained or the morale of the infantry be materially increased.

5. To come to the assistance of other batteries. Batteries designated for this duty are called *reinforcing batteries*: * * * *

6. To draw the fire of the enemy's artillery which has not yet disclosed itself. Such a battery is called a *decoy battery*.

* * * *

The above examples must not be construed as authorizing a rigid, unchanging division of duties. Individual batteries may be called upon to perform, during the course of an engagement, all of the functions indicated.

The superior field artillery commanders must follow closely the developments of the action and make such modifications in the duties to be performed and the sectors to be covered as will make it possible to quickly concentrate the maximum obtainable fire upon the targets which at any particular time are most dangerous to our infantry. (F. A. D. R. Par. 1469)

Employment of fire: In the employment of fire, the field artillery is guided by the following principles:

The power of artillery should not be frittered away in desultory bombardments nor upon unimportant targets. Its employment is to be adapted to the phases of an action, so that it may exert the strongest influence upon the important objectives and at the critical moments.

The opportunities of striking an enemy while he is vulnerable are ordinarily intermittent and brief. They occur, for example, when the enemy moves from cover to cover, or when he exposes himself in order to contend effectively against our own troops.

Suddenness of action is thus often a necessity. If the action is also by surprise, effect, especially the moral effect, is increased.

The outbursts of rapid fire called for will therefore be intermittent, depending upon the nature and phase of the combat.

A prolonged deliberate fire, however, may be requisite for destroying material objects; for holding a sheltered enemy under subsection, preventing his supply and reinforcement, and precluding his effective interposition in the engagement; for searching for an enemy's reserves, etc.

Opportunities for using flanking and oblique fire must be sought.

These methods of action are made possible and effective by timely reconnaissance, by skillful selection and occupation of positions, by careful preparation and an efficient conduct of fire, and by thorough coöperation between the artillery and the troops it is ordered to support. (F. A. D. R. Par. 1470)

Economy of Ammunition:—It is made the duty of every field artillery commander to exercise constant and unremitting care to economize ammunition.

Ammunition is to be economized by carrying the adjustment to the degree of certainty permitted by the conditions and especially by not firing on small and unimportant targets. Fire when once opened must be sufficient to produce the result required but all officers must, by careful supervision and observation, aid in preventing extravagant expenditures. (F. A. D. R. Par. 1471)

It will be seen that an action may not be characterized by a continuous cannonade but rather by bursts of fire and periods of silence on the part of the batteries. The infantry must accustom themselves to this condition and not fall into the error of thinking their supporting batteries are out of commission because momentarily silent. It is realized that the sound of the supporting guns is a powerful moral support to attacking infantry but it can be readily appreciated that the proper tactical use of the gun and conditions of ammunition supply must prevail in its use in the early stages of the combat. In the later stages when every effort, physical and moral, is being used to close on the enemy with bayonet and sabre it is more than likely that every available gun will be turned on the hostile lines in one continuous stream of fire.

“The Manchurian War permitted ascertaining facts worthy of notice. * * * * * When the Japanese perceived the Russian trenches before which they had been using up their troops for so many hours, bombarded in a terrifying manner by the combination of field artillery and the heavy artillery; when they saw before them thick clouds of smoke and dust interspersed by the flashes of the shells which were bursting above the trenches; when they heard the thunder of those shells covering the whole field of battle, their enthusiasm no longer knew any bounds; they dashed forward to death or glory with savage fury.” (Critical Study of German Tactics—Pardieu, page 50)

Assignment of Field Artillery to Detached Organizations: While it is an established principle that field artillery can develop the full measure of its efficiency only by a strict adherence to the foregoing general principles in its tactical employment there are certain cases where an actual subdivision is necessary, a subdivision that must be decided upon and ordered by the commander of the troops. These are the assignments of artillery to protective and reconnaissance bodies such as *Advance, Rear and Flank Guards and Outposts*. One general rule may be given which is applicable to practically every conceivable situation and that is that *every such assignment should be of whole units*. If more than a battalion is considered necessary, send a regiment if possible; if more than one battery is needed, send a battalion. *The detachment of one of two guns or the breaking up of a battery is rarely if ever permissible. A battery is a firing plant of the smallest size consistent with economy of men and matériel, and the removal of any of its parts not only results in a sub-unit whose efficiency is far below its efficiency when in battery, but reduces the efficiency of the battery itself in far greater proportion than that of merely the proportion detached. The basic plant, the battery should be kept intact. If several batteries sustain losses of men, animals and guns, temporary consolidation of the parts remaining is ordinarily preferable to the reduced units.*

Advance Guards: The composition and strength of an advance guard is dependent upon its duties and the tactical situation. Whether or not it should contain field artillery and its proportion is therefore a matter of estimation and decision in each particular case. In general a division is the smallest unit employing artillery in its advance guard. If combat is imminent or heavy resistance is expected, a battalion should be sufficient as there are grave objections to the detail of a regiment to this duty. As now organized a regiment (firing batteries only) takes up nearly a mile of road space and its presence in an advance guard is bound to unduly separate the infantry elements; the security of this long column of carriages is likely to cause the advance guard commander some apprehen-

sion and its proper employment is likely to disturb his equanimity. Its mere presence is likely to cause the advance guard commander to commit his command to a hasty or improper use and thus involve the advance guard in a combat not contemplated by the division commander or one that will commit the division commander to a form of combat not to his liking. So much artillery in the advance guard is therefore likely to be a white elephant on the hands of its commander and to deprive the division commander of the full measure of his own initiative in instituting combat. There may be special cases when such a large assignment is proper, as, for example, an advance to specially prepared or reconnoitered positions, or an advance against thoroughly reconnoitered hostile positions, or an advance behind a carefully prepared and well conducted cavalry screen, but care should be taken not to overburden an advance guard with an unnecessary preponderance of field artillery. There may also be cases where a single battery will suffice in the advance guard of a division as where the resistance takes the form of annoyances and delays by small bodies of the enemy. A re-enforced brigade may assign a battery of its artillery to its advance guard under special conditions; in smaller detachments than this containing field artillery, the road spaces and distances are usually so reduced that nothing is gained by sending any of it ahead of the main body and security conditions usually dominate and require that it march there.

Horse artillery marching with cavalry should march united and well to the front of the main body. As a rule a battery should not be detached with the advance guard.

Pursuit: An ideal pursuit would be one in which fresh infantry supplied with field artillery well to the front in its column was in close touch with the hostile rear guard, while fresh cavalry and plenty of attached horse artillery was rapidly gaining its flanks on convenient parallel roads with a strong chance of cutting off or holding up the hostile main body. The circumstances of any pursuit will probably always be such that only part of these ideal conditions can be realized.

A prime characteristic of any pursuit should be its viciousness and unrelenting prosecution and the energy of man and beast should be taxed to the ultimate limit to turn the retreat into a disaster to the hostile force. To this end, commanders are frequently inclined to take long chances. The pursuing infantry, generally in the first stages, can only follow in trail until the retreating force can be checked by mounted troops operating on its flanks. This trailing column needs some artillery but the most effective use can usually be made of the guns by getting them where they can bear on a flank. This may be accomplished by the use of cavalry escorts, but due regard must be had of the enemy's ability to make sudden offensive returns. If horse artillery be lacking there should be no hesitation in attaching light batteries to the cavalry if the tactical situation warrants it and the artillery horses are in any fit condition.

Rear Guards: No guns should be assigned to mere baggage guards or to small rear guards intended to keep off hostile mounted troops. A fighting rear guard protecting the retreat of the main body should have field artillery and in the case of a rear guard covering the retreat of a defeated force practically all the guns should be turned over to it, as they are a powerful auxiliary in forcing a deployment and otherwise delaying pursuing troops.

Flank Guards: This is so dependent upon the mission of the flank guard and the tactical situation that no general rules apply. The proportion of guns will vary but only in exceptional cases should it exceed one battery for a single infantry regiment of a battalion for two regiments or an infantry brigade. In nearly all cases of flank guards, the main body usually has out an advance or rear guard in addition and there is grave danger of the loss of unity of direction by parcelling the artillery among the three bodies.

Outposts: Field artillery is rarely assigned to outposts for night duty. The necessity for its night use is exceptional and as it must usually remain harnessed if not actually hitched up the duty is very fatiguing to the animals. If a daylight attack

on the outposts is anticipated, positions for the artillery units should be reconnoitered and the routes thereto marked out. Daylight should then find the artillery in readiness to occupy them or otherwise move to the support of the outposts. Artillery is useful to outposts when its fire can sweep defiles or large open spaces and when it commands positions that can be occupied by the hostile artillery.

CHAPTER XIII

COÖPERATION—ORDERS TO FIELD ARTILLERY

Ten years ago the title of this chapter would, according to the then current phraseology, have been "the support of infantry by artillery." Such phraseology is logically unsound now. "The old idea was that the infantryman did his work in his own way getting such help as the gunner chose to give him. The modern idea is that both work together, their action being mutually inter-dependent." If the old idea held and infantry were launched to the attack without any previous mutual understanding between them and their artillery, a great percentage of the efficiency of the artillery would be lost to the infantry with the necessarily marked increase in their casualties and the introduction of another element of jeopardy in the outcome of the combat. Briefly the necessity for co-operation may be summarized thus:

- (a) That the fire of the artillery may be directed against objectives which *are* the most *serious obstacles* to the infantry and not against those *appearing* to the artillery as the most serious.
- (b) That the fire of the artillery may be promptly brought to bear upon serious obstacles hidden or not perceived by the artillery.
- (c) That the volume of fire may be augmented just previous to forward bounds of the infantry lines and at the various crises of an engagement.
- (d) That the artillery may act promptly and with self reliance when the combat takes an unexpected or unforeseen

turn. Despite the most rigid adherence to original orders the combat may frequently assume wholly unexpected phases.

To attain these ends it is necessary that the field artillery have a thorough understanding of the tactical situation, of the decision of the commander of the troops, and of his complete orders—not only those orders respecting the field artillery but those concerning *all of the combatant troops*.

It is therefore necessary, and it is prescribed that *prior to the combat the field artillery commander habitually accompany the commander of the troops and remain with him at all times so far as may be practicable*. When compelled by circumstances to leave the general commander, he should leave a representative and if compelled to remain absent for any length of time, reliable communication between the two should be established and maintained. *It is the duty of the senior artillery commander to submit to the commander of the troops in ample time for appropriate action, recommendations concerning the position and use of the field artillery of the command.*

Naturally these should not be made in the spirit of criticism, but absolutely in furtherance of the general plan and they should be received and considered by the general commander whether welcome or not.

To attain full measure of success in this respect, the artillery commander should cultivate such personal relations with the commander of the troops that he will not be *persona non grata* to the latter on his staff. On the other hand the commander of the troops and his staff should appreciate the rôle the artillery commander is required to play and not render his task more difficult by indifference or by interposing obstacles.

(a) As a rule, the field artillery commander accompanies the commander of the troops during the earlier stages of an engagement and receives the orders of such superior commander in person. As the engagement progresses it may be necessary for the field artillery commander to establish his position at a point other than that selected as the position of the commander of the troops. In such cases the duty of maintaining communication between the superior commander and the field artillery commander devolves, in general, upon the signal corps. If, however, the signal corps is for any reason unable to supply such communication, or if it is not ordered, the field artillery commander furnishes the personnel and matériel necessary to maintain connection with the superior commander.

In every case of absence, the field artillery commander is represented at the headquarters of the superior commander by an agent designated from among the field artillery personnel for the purpose.

(b) When a given force of field artillery is told off to render support to a given force of infantry in accomplishing a definite purpose, the artillery commander should be informed as to the plan of the infantry commander, and the two commanders should arrange by conference beforehand as to means of communication, method, etc., to be used to insure close coöperation. To insure effective coöperation it is essential that the field artillery be kept informed as to the losses sustained by the infantry, the particular part of the hostile line from which the fire causing the greatest losses comes, the movements and any change of plan of our infantry, also as to when it is necessary to begin, increase the rate of, or cease firing. An artillery reconnaissance officer with artillery scouts, or artillery scouts alone, may be employed to establish the requisite means of communication, which may be by courier, signals, or telephone. The reconnaissance officer and scouts also report on the effect of the field artillery fire and furnish such other technical data as they may be able to obtain. It may frequently be necessary for the infantry to furnish additional means of communication. Especially is this necessary during the last moments of an assault, when previously concerted signals for the cessation or shifting of field artillery fire must, as a rule be given from the infantry firing line. (F. A. D. R., Par. 1519)

It is unnecessary to add that by *coöperation* all that the word implies is meant. It is a "coming together of all parts concerned" for mutual understanding and must be indulged in by the infantry just as much as by the artillery. The entire object is very likely to be defeated if it is made perfunctory or put on the basis of rank or command, or brought about by harsh or unnecessary orders. To be effective it must be spontaneous and characterized by thorough good will and friendly feeling on the part of all concerned.

To secure decisive results, troops must advance, occupy the hostile position and by vigorous pursuit destroy or throw into confusion the hostile forces. The isolated and independent action of Artillery leads to no decisive results. Close coöperation between the Artillery and the troops which it supports is, then, necessary for effective action. To insure this there must not only be a mutual understanding of each other's methods of action, powers, and limitations, and sure and rapid means of communication between the various elements concerned, but there should be a preliminary conference between the Infantry and Artillery commanders concerned as to the definite plans of each, their expected development and the communication to be employed. (F. A. D. R., Par. 1466)

The matter of coöperation between the different arms has received much more attention abroad than it ever has in the

United States. Especially is this true in the French Army and especially there with reference to the coöperation between field artillery and infantry.

"During the past three years more attention has been given by the French military press to the matter of communication between the several arms than to any other subject. That no one particular method of accomplishing this liaison has as yet been generally accepted as the best, is indicated by the heated nature of the controversies between the advocates of the various systems proposed: moral liaison, physical liaison, liaison from the top, liaison from the bottom, or combinations of two or more methods of liaison. In one form or another, however, the liaison always exists between the artillery and the infantry. It is true that in our service we also advocate this liaison, and our drill book prescribes it; but how often do we actually establish it at our small maneuvers; how often do we think about it; in short how much do we even mentally practice it? It may be interesting to note that while the artilleryman believes in the liaison, it is especially the French infantryman who insists that his artillery must promptly provide for this communication between the two arms. There is everywhere a very close understanding between the French infantry and artillery." * * * * * (Journal, U. S. F. A., April-June, 1913)

ORDERS

In a chapter on Self-Reliance in his "War of Today," Von Bernardi says:

"In order to prevent the self-reliance of the various groups and men leading to confusion during the battle, and that they may act in accordance with the intentions of headquarters, it is imperative to adhere rigorously to a systematic issue of orders *before* entering battle. Everybody must know so much of the general situation as is requisite for him to know within the sphere of his command to enable him to act with self-reliance under any circumstances, even should the conditions be found to differ from what the order presumed, or change in the course of action. He, only, who knows the plan of the whole, is able to act suitably in sudden emergencies. * * * * * It is necessary, also, to *issue to the artillery, orders, which will enable and permit everybody to act with self-reliance. It is not enough to indicate to the various artillery brigades and batteries their positions and targets. Far more important is it for all to be informed of the tactical object of the fire. The artillery must know the task given to the infantry in the battle, and must be in position to judge fully how it can best aid the infantry in solving its task, so that all subordinates, knowing the situation are perfectly free to act with self-reliance at the given moment.*"

We have seen that to get the most out of an artillery command, its commander should be treated somewhat as part of the staff and as such will know his orders better than they can be written. The *formal order*, either verbal or written is then

merely a protection to the commander of the troops, and to the commander of the artillery—an announcement to the command of the functions of the artillery in the impending combat and something authoritative for the artillery commander in dealing with the subordinate and coördinate commanders.

Like all orders they should be clear, concise, brief and unequivocal. In general they designate the approximate locations of the artillery command and its tasks. With such special instructions as circumstances may seem to render advisable. In large commands like a division it is usual to issue a "combined order" that subordinate commanders may know definitely the tasks assigned the artillery units and the measure of assistance they may each expect from them. In an attack, the orders of the superior commander should specify then, not only the areas or locations of the artillery commands and the routes to be followed thereto, when necessary, but the *infantry units*, whose attack is to be supported. Such an order gives the commander of the supporting artillery unit, the necessary latitude to direct his fire attack not only on the front which his infantry unit is assaulting, but upon any other hostile formation which may impede its advance during the course of the combat; to arrange for the necessary communication with it and to continue this support to the very end of the conflict by appropriate movements of his batteries.

In a purely defensive action it is customary to divide the front into sectors, assigning the troops, including field artillery units, to the various sectors and usually placing a superior officer in command of each sector.

When field artillery units are mentioned in orders, it is habitually understood by the field artillery that the entire unit is affected, the same as with units in the other arms. In order to increase the mobility of the firing batteries, expedite their entry into action and to decrease the depth of the combatant column it will be frequently advisable to separate the combat trains from the firing batteries and assign these consolidated combat trains to a march position in rear of the other combatant troops. (See Chapter XIV.) This is accomplished

by inserting in the operation order after the designation of the field artillery unit thus affected, the expression: "less combat trains," adding to the order appropriate instructions for their march position or other movements. Upon deployment of the march column for combat these combat trains will habitually seek to rejoin their proper batteries and battalions. (See Chapter XVI.) There are 190 rounds per gun in each firing battery but due to the fact that certain batteries may have an excessive expenditure of ammunition it will ordinarily be better to permit these trains to rejoin in order that this first ammunition reserve may be available, but the situation should be carefully examined by the commander of the troops to see if the forward movement of these combat trains will seriously interfere with later movements of the command and appropriate orders regarding them should be given if such be the case. This matter should be particularly considered in case the command is likely to resume its march order without much of a combat and particularly if the march is going to be in the rear. The decision should be the result of an estimate and not the result of copying any set form and the recommendation of the artillery commander should be considered in coming to the decision.

It should be noted that field artillery is specially commanded by its drill regulations to maintain its ground when threatened and that the withdrawal of such threatened units must be by order of a superior. In view of the strictness of the regulations on this subject it is only fair to the subordinate to give such an order in writing, however brief it may be.

CHAPTER XIV

POSITION IN COLUMN

For route marches in time of peace or not in the immediate presence of the enemy great latitude is allowable and generally the comfort of the troops is the permissible controlling factor.

Artillery, like any mounted organization, is a nuisance to foot troops when immediately preceding them, on account of the dust and the damage it does to the roadway footing. The

normal walk gait of the horse or mule is so much in excess of that of foot troops that marching immediately in rear of foot troops results in backing and filling in the artillery column, a process trying alike to man and beast. Sandwiching it in a column of foot troops is disagreeable to both the foot troops and the artillery. It is, therefore, better under the above mentioned circumstances when a single road only is available to let the artillery precede foot troops by one or two marches or allow it to start its march so that it will close up on the infantry not sooner than the end of each day's march. If other roads are available it may be sent by them. In any case the fatigue of a march may be greatly lessened by arrangements which permit it to take its own gait.

In forced marches, as for example, a case where it is desirable to transfer a body of field artillery from one point on an extended front to another in the least possible time, and where the tactical situation permits, the march may be expedited and fatigue lessened by increasing the distance between units until the individual platoons or sections can regulate their own gaits, taking the walk on steep and bad portions of the road and closing up on level and easy grades.

The proper formation of a column of all arms for a march in the presence of an enemy is possible only with a thorough understanding of the tactical situation and a complete knowledge of the powers and limitations of its combatant elements. A thorough knowledge of road spaces occupied by the various units and the probable elongation of each due to road and weather conditions, morale and physical condition of the troops are of prime importance. The regulation road spaces given in the F. S. R. will elongate not less than 10 per cent according to many authorities, under the very best conditions and run 50 per cent even under average conditions.

The Combat Trains: In our organization of field artillery it will be noted that the combat trains, 6th, 7th, and 8th sections, or first ammunition reserve, are an integral part of the battery. In a brigade of field artillery these battery combat trains occupy a total of 1650 yards of road space, approxi-

mately one mile not counting unavoidable elongation. It is extremely unlikely that any division commander will permit one mile of combatant road space to be thus utilized in a march in the presence of the enemy.

It will, therefore, be customary and proper to consolidate these combat trains and march them just in rear of the combatant troops during an advance in the presence of the enemy. Conversely, in a retirement, they should just precede the combatant troops in column. In a regiment of field artillery, the length of the combat trains amounts to about one-half mile, and similar action applies. In a battalion the combat trains occupy one-quarter mile road space which is still too much to sacrifice and the same action is proper. In the case of a single battery the gain in road space is too small to warrant such a division. Batteries assigned to an advance or rear guard should ordinarily be so assigned, intact, i. e., with their combat trains. The assignment of field artillery to these duties implies probable combat and it would not be good tactics to interpose the whole of the main body between this artillery and its first ammunition reserve. In the formation of the advance or rear guards, the combat trains of their artillery may be properly separated from the firing batteries and assigned to march position just in rear of the combatant troops of the advance guard or just ahead, in the case of a rear guard. Whether or not the combat trains of artillery assigned to flank guard should accompany the firing batteries and their proper march position in the flank guard can be worked out on similar principles according to the special tactical situation.

Advance Guard: An advance guard consists of a series of combatant bodies increasing in size from front to rear. The resisting power of these bodies is comparatively small until the reserve is reached. Furthermore the distance from the leading infantry element to the support even in a heavy advance guard of a division is usually less than a mile. It is, therefore, unwise to place any artillery farther forward in an advance guard than the reserve as it is liable to be cut off by an energetic

enemy in a recontre or to come under hostile artillery fire when in column of route. It is true that field artillery can go into action wherever it finds itself but its efficiency is immeasurably increased if it has some choice in the selection of its positions. In other words it should never be so placed that its choice of position is avoidably restricted; some "maneuvering area" is essential to its maximum efficiency. To give it this maneuvering area without requiring it to make a movement to the rear, which is lost motion and has a bad effect on the morale of all the troops, is another argument for placing it well back in an advance guard formation. The first troops deployed in an advance guard action will be infantry and a logical conclusion would be that the artillery should march just behind the infantry which is liable to make the first deployment and ahead of that which the advance guard commander would hold out as a temporary reserve. Thus in a division advance guard composed of a brigade of infantry and a battalion of field artillery, the artillery firing batteries could march in the advance guard reserve with two of the infantry regiments ahead of them, and one infantry regiment following them, the artillery combat train following this third infantry regiment. In a few words, *"the center of gravity of the artillery of an advance guard should be well to the rear of the formation."* It thus is secure from a sudden "rolling back" of the advance guard in a recontre, less liable to receive hostile artillery fire when in column of route and has "maneuvering area" forward. Its superior mobility enables it to move forward to position at an increased gait while its definite position is being reconnoitered.

The Pursuit: Whether or not the artillery should be moved forward any in the advance guard of a pursuit is largely dependent upon the activity and ability of the enemy's rear guard artillery. If too far forward he may catch it exposed in column of route and badly cripple it. On the other hand the long range of its fire makes it one of the most formidable weapons in the hand of the pursuit commander, and the circumstances of a pursuit usually warrant the taking of long chances.

Rear Guard: Such a variety of conditions are encountered in rear guard duty that a few general principles only can be given as to the location of artillery in the original formation. Its maneuvering area should be in the direction of the march (the rear) but as reconnaissance officers can precede the rear guard and select positions, the position of the artillery in column is not of so much importance in this respect. It should not be so far to the rear as to render it liable to being cut off by hostile cavalry or flanking columns. The retirement of a rear guard closely pursued is usually by alternate portions. If each of these portions is a mixed force of infantry and artillery, it may be well to let the artillery of the retiring portion precede the infantry of that portion, thus giving it more time to get into its new position to cover the retirement of the rear portion.

Flank Guards: The position of the artillery in column in flank guards is dependent on the foregoing principles of security, maneuvering area and the tactical situation in which the probable direction of hostile opposition is the preponderant feature.

Main Body: The advance guard and the distance between it and the main body render the artillery marching in the main body of an advance, secure from that direction and ordinarily give it the necessary maneuvering area forward so these conditions rarely enter the problem. Any order of march should be based primarily upon the order in which the troops are to be deployed. As the field artillery almost invariably will be called upon to support the advance guard, to cover the deployment of the infantry of the main body and to initiate the fire attack it should be well forward in the main body. It should, however, habitually be preceded by *some* infantry at the head of the main body, either the remainder of the brigade or regiment which precedes as the infantry of the advance guard or a battalion from the next regiment in column.

Under certain circumstances, however, when the column of artillery is very long, it may be advisable, for purposes of protection to interpolate infantry units. In general, therefore,

the "*center of gravity of the artillery of the main body should be well forward in the column, in an advance.*"

In night marches, in a country where artillery would have no chance to deploy and in operations that must be begun exclusively by infantry, the artillery should be relegated to the rear of the column.

In a retreat, based on the same reasons which assign the bulk of the artillery to the rear guard, any, not so assigned, should march well to the rear of the main body column (with similar provisions against flank attack) in order that it may be in position to promptly re-enforce the rear guard.

CHAPTER XV

RECONNAISSANCE AND SELECTION OF POSITION

Choice of Position: The duty of locating the enemy and of securing information concerning him devolves in general upon troops of the other arms. The field artillery personnel is not equipped for, nor regularly practiced in such work and should not be detailed for such duty. As little or no such information will be furnished him by members of his own command, it is, therefore, essential that the officer commanding the field artillery should be in close touch with the officer commanding the troops and that the personal relations of the two be such that the recommendations of the former should be solicited and considered. It remains for the latter, however, to decide the general locations or areas within which the field artillery must take position and he influences the distribution of batteries by indicating the tasks or duties the artillery is to perform. If confusion with other troops is likely to occur he must specify also the routes the artillery must take to their respective positions. In order that such a commander be not wholly at the mercy of his artillery commander he should have some knowledge of the technique of the arm and of what influences choice in position.

The only available rule to be followed in the assignment to position is that *it must be such that the guns will be able to*

carry out effectively the task assigned them. Other important considerations are:

1. Obtaining a range not much greater than 3,000 yards.
2. Securing a large field of fire.
3. Concealment from view.
4. Good observing stations in the vicinity.
5. Facility of movement to the front, flanks, and rear.
6. Proximity of good cover for teams.
7. Favorable conditions for resupply of ammunition.

Positions combining all of the above qualifications are seldom or never found. The choice as to which consideration most weight is to be attached depends upon the tactical situation.

In the selection of positions it should be borne in mind that extended movements of field artillery columns over the field of battle are to be avoided even if made under cover, when noise and dust clouds are liable to warn the enemy of the movement and subsequent position; that the percussion fuse of the shrapnel is so sensitive that impact, even in light foliage, bursts it, hence positions should not be taken behind woods as a mask unless the projectiles are certain to clear the foliage and that firing over friendly troops must be regarded as a normal procedure.

The Artillery Reconnaissance: The field artillery commander having accompanied the commander of the troops on his preliminary reconnaissance, having received a thorough understanding of the tactical situation and the plans of the commander of the troops, having made his recommendations, and having received his orders regarding the plan of action of the command, should, if possible, at the earliest opportunity reconnoiter the ground that is to be the scene of action and select as far as possible the definite positions for his units in accordance with the instructions he has received and the tactical requirements of the situation.

This reconnaissance in the case of large commands may be very general, for example, merely a survey of the scene of action from some commanding point supplemented by the use of accurate maps, or it may be more in detail according to time available and the opportunities. It should be habitually supplemented by more detailed information as to the ground

available for occupation, secured by artillery reconnaissance parties which have been attached to advanced troops for this purpose. In whatever way his reconnaissance may be performed he causes his immediate subordinate commanders to accompany him, or informs them when and where they are to report to receive their instructions and undertake their own reconnaissance. It is important that they should reach the ground at the earliest practicable moment.

In undertaking a reconnaissance an artillery commander should have a clear idea in his mind of the general plan of action and of the task to be accomplished by the force under his command. Unembarrassed by details, he should study the tactical situation and the lay of the ground, select the position with a view to carrying out his special mission, and arrange for the necessary preparatory dispositions. The details of securing information, etc., should be performed by reconnaissance officers and scouts.

In general, therefore, the Senior Artillery Commander:

- (a) Informs himself as to the enemy's location and dispositions and the general plan of the commander of the troops.
- (b) Examines the terrain.
- (c) Submits to the commander of the troops recommendations as to the use of and positions for the Artillery.
- (d) Assigns the regiments, and, if necessary, smaller units, to duties and to areas to be occupied in accordance with the plan decided upon by the commander of the troops.
- (e) Takes general measures to insure communication between the Field Artillery and the other arms, as well as between the elements of the Artillery itself.
- (f) Takes general measures for the security of the Field Artillery in combat and its resupply.
- (g) Takes definite measures to insure communication between himself and the commander of the troops. (F. A. D. R., Par. 1592)

Regimental commanders conduct a similar reconnaissance of their areas, assign their battalions to positions and duties with as much exactness as conditions permit, amplify or supplement the arrangements for communication within their regiment, and with the troops they are to support, and supplement the instructions as to support and resupply of ammunition with more detailed arrangements. Battalion commanders pursue a similar course of action within their sphere of command including arrangements for security and routes for subsequent move-

ments and the means for securing efficient fire direction. Battery commanders take similar action as to their commands including the necessary details for securing efficient fire control.

Since the proposed plan of action influences the choice of positions, it is important that all of the above commanders transmit to their subordinates all available information as to the plan of action and the part to be taken by their respective units.

In case of engagements in which large bodies participate, the original entry into action will generally be sufficiently deliberate to enable well instructed field artillery to make the necessary preliminary reconnaissance to secure the best technical and tactical advantages of the ground and of the situation, and the critical phases of the ensuing combat requiring changes of position on the part of the field artillery will generally not arise so quickly or rapidly but that there will be sufficient time for the artillery to make all arrangements for the movement, provided there is thorough coöperation between the field artillery and the infantry and provided that both infantry and field artillery commanders exercise a reasonable amount of forethought. But in the absence of these conditions, in case of *surprises*, in the case of rencontre engagements of small forces, in unexpected and unanticipated crises, and particularly in cavalry combats, when it is necessary to bring the guns into action quickly for the support of other troops or when sudden changes of position are imperative and the main consideration is to get the guns as promptly as possible to a place where they can immediately render effective support, any delay occasioned by a search for technical and tactical advantages is not only inadmissible but a grave error.

CHAPTER XVI

ADVANCE TO AND OCCUPATION OF A POSITION

Subdivision for Action: Each battery of field artillery consists of the firing battery, the combat train and the field train. The field train will ordinarily march with the field trains of the

command to which the artillery is attached and until released, conform to the orders given the field trains by the general commander.

When no orders respecting the combat trains are given by the general commander, the field artillery battalion commanders may permit the combat trains to march with their respective batteries or they may consolidate them by battalion and march them in rear of the firing batteries of the battalions. If the combat trains are thus marching with the artillery command, the field artillery commanders must give the necessary orders to effect a subdivision of the firing batteries and the combat trains before reaching the position to be occupied. If this is done too far away from the position other troops may interpose and delay resupply of the firing batteries.

In order to expedite the entry into action of the combatant troops, the general commander may direct the field artillery combat trains to a march position in rear of the combatant troops of the command, in which case they are habitually assembled by battalion or regiment under the command of the senior officer present with them and take their places in columns as ordered.

The position for the group of combat trains can ordinarily be selected and the agent dispatched in ample time to guide the train to its position.

Upon reaching the position the commander of the group posts it to facilitate movement and to utilize the available cover. Ordinarily the carriages are posted with sufficient intervals to permit the free passage of vehicles which may be brought up.

Having posted his train the group commander sends the agent who has guided him to the position to report to the major. He then informs himself as to the position of the distributing station and assures himself that communication and the supply of ammunition to his group are maintained.

If on approaching the position of the firing batteries the group commander has not received instructions as to the position he is to take, he halts his train under cover, reconnoiters and selects a position. Having posted his train he immediately takes steps to establish communication with his battalion and battery commanders and with the ammunition train.

During the action the group commander orders such movements of the combat trains as his instructions and the developments of the action may from time to time require; he uses every means in his power to ensure the uninterrupted supply of ammunition from the combat trains to the batteries on the one hand, from the ammunition train to the combat trains on the other. (F. A. D. R., Pars. 1659-1668)

Advance to Position: All field artillery commanders habitually precede their commands to the position to be occupied, and return in person or send a qualified agent to conduct the organization to its position. If the organization is to follow at once the commander instructs the officer left in command as to the tactical situation; the time and place for subdivision, if such subdivision has not been made; the route to be followed; the rate of march.

Every effort should be made to conclude all preliminary arrangements prior to the arrival of the firing batteries. The advance to and occupation of the position should be without the knowledge of the enemy, if the tactical situation permits it. Opening fire should surprise him. This involves defilade against possible hostile observing stations as well as against artillery positions.

To avoid raising dust, movements in the neighborhood of a masked position should habitually be made at a walk. If exposure in the route of approach is unavoidable, such place should be passed at a rapid gait and, if necessary, by the successive movement of carriages. Another method for crossing an exposed area is to advance all the carriages simultaneously on a broad front at a rapid gait.

The approach to and occupation of positions under cover of darkness is of frequent occurrence. In such cases the route must be most carefully marked at close intervals and all the details of the movement determined in advance by reconnaissance during the day.

Occupation of the Position: If the position is masked the firing battery may ordinarily be drawn to its exact place by the teams, unlimbered and prepared for action, without drawing fire.

A definite decision, however, must be made as to the extent to which a masked occupation of the position is permissible or possible. If the occupation of the position will be at all visible to the enemy, delay in getting the horses away from the battery and in establishing the guns and caissons in position may be fatal. It may be preferable in such cases to require

the horses to draw the guns boldly to positions from which they can immediately open fire, without any man handling whatever.

When direct laying is to be employed and the guns *must* come into the open, probably the best course is to prepare the pieces for action, and conclude all preliminary duties, including designation of the target and instructions for opening fire while under cover, advance rapidly to position and quickly unlimber. If the guns are to take merely sight defilade it may be better to unlimber completely under cover and man handle them into position.

DISPOSITION OF LIMBERS AND AMMUNITION RESERVES

The preservation of the ability to move artillery depends upon the protection of the teams from hostile fire.

The Limbers: The position to be occupied and the formation to be taken by the limbers depend upon the nature of the cover available. To secure the maximum protection and to have free and prompt access to the guns are the objects in view in selecting the position for the limbers.

The distance to which they may be removed is dependent on the time required to get them to the guns and limber up and is also a function of the particular tactical situation. It should rarely exceed 400 yards.

When it is impracticable to conceal them from the view of the enemy, they should be posted as far from the guns as the conditions of the case warrant, and formed in line, faced toward the enemy, with as wide intervals between carriages as the ground and the situation will permit, and generally echeloned with respect to the firing battery.

Position of Combat Trains: Ordinarily a position for the combat train is selected during reconnaissance, and an agent is sent to guide the commander of the combat train to his position. If this is not practicable the commander of the combat train halts his train under cover, reconnoiters, and selects a position. Protection from the fire of the enemy and a covered approach to the guns are the objects sought. As a rule it is desirable to have the combat train within 600 yards of the guns; if, how-

ever, ample cover is not available, this distance should be somewhat increased.

The commander of the combat train, after having posted his train, makes all necessary provisions for further movements of his train, supplying ammunition, and maintaining communication with his immediate commander. In large commands, it is usually necessary to assemble the combat trains by battalions, and it may be necessary to provide for maintaining communication with the several firing batteries, in addition to the communication maintained with the battalion commander.

The ammunition train, as a rule, marches in rear of the main body. At the beginning of an engagement the sections of the train are directed to proceed to stations from which practicable routes radiate to the combat trains. Usually the most suitable preliminary locations will be found at a distance of from 2 to 8 miles in rear of the line of battle. Inasmuch as the expenditure of ammunition will not be the same for all parts of the line, it is, as a rule, desirable to hold the sections together during the earlier stages of the engagement. As the probable course of the engagement becomes known it may be advisable to subdivide the sections and to station the subdivisions at such places as will facilitate the resupply of the combat trains. (F. A. D. R., Par. 1712)

Changes of Position: If conditions permit the field artillery should be so posted at the outset that it can act effectively throughout the various phases of the engagement without change of position. If the guns are rendering effective service a change in position should be made only when some distinct advantage is gained thereby. A reduction in the range is not of itself ordinarily sufficient to warrant a change if the guns are doing effective work and their continuous action is important. Any change of position involves: cessation of fire, a new reconnaissance and occupation of position, a new adjustment of fire, an adjustment of the observing personnel to the new conditions, and ordinarily the establishment of new lines of communication and ammunition supply.

However, such changes may be made imperative as an action develops, either forward or to the flank, or to reach positions for covering a movement to the rear. It is essential that artillery officers anticipate and prepare for such movements and that superior commanders give them early information of any contemplated movement by the other troops which will require

a change of position of the guns. It should be borne in mind by all concerned that limbering up and movements under effective hostile fire may result in paralyzing losses of men and animals; in such cases a lull in the action must be awaited for moving the guns by hand to a position where they may be limbered under cover. If a repulse is imminent and the guns are being threatened by the enemy's advancing troops, then the opportunity for withdrawing must be gained by beating back the enemy and securing at least temporary immunity from his fire. It is useless to bring up the horses under close and effective hostile fire. On the other hand, artillery, as long as it has ammunition, should be able to thoroughly protect its own front. At the last, officers and men should take shelter among the carriages and with their pistols force the enemy to pay the dearest price for the possession of the guns.

Changes of position of the larger bodies of artillery are usually made by echelon, a portion of the force being thus always in position to cover the movement of the remainder. A single battery, however, is not ordinarily echeloned for a change of position; but when a movement has to be made across a fire-swept zone, it may be necessary to move by single carriages.

When an important change of position is imminent, battery commanders must endeavor to have the ammunition chests of the firing battery fully replenished in readiness for the movement.

A battery which has expended all its ammunition does not for that reason retire; it secures a fresh supply. While awaiting replenishment it shelters the unemployed personnel.

A disabled gun is not sent to the rear during the action; if it cannot be repaired on the firing line it is left there.

As a rule, batteries are not relieved, but are supported by fresh batteries.

"Batteries will not retire, even in the face of imminent danger, without orders. The loss of well-served guns in the defense of a position, or in close support of the other arms, is honorable." (F. A. D. R., Par. 1678)

The question of changes of position is intimately connected with the action of the so-called *infantry* or *accompanying*

batteries. It is generally conceded that these batteries when rendering effective assistance should effect this *accompaniment* by *fire* rather than by actual changes forward. The effect of the arrival of batteries on or near the firing line will undoubtedly be great on the morale of the infantry and it is a question whether this effect will be sufficient to counterbalance the losses that may be sustained in the artillery and those resulting from the interruption of its fire due to the movement. It has been proposed to make one or more batteries of mountain artillery an integral part of an infantry division for the purpose of giving this moral support to the firing line as this form of field artillery is more mobile and can advance with less danger of loss than the field guns.

CHAPTER XVII

COMBAT

The Attack: In general, when large forces are engaged, the attack presents three principal phases:

1. The preparation.
2. The decisive action.
3. Securing the victory, or averting disaster in case of failure.

Formerly, when field artillery was compelled to habitually take position for direct fire and the opposing artilleries were more or less exposed to each other's view, it was possible to materially damage each other by fire, and every combat usually opened with a duel between the opposing guns which ordinarily ended in one side gaining a material ascendancy over the other by destroying or silencing a majority of the opposing guns. If the assailant were the victor in this artillery struggle, its termination was usually the signal for commencing the infantry advance. With the opposing guns concealed from each other's view this dead open and shut proposition of one side seriously crippling or silencing the other is problematical. If the hostile batteries are properly placed in concealment and decline to fire in the early stages of combat only aerial reconnaissance

will disclose their location. If they do open fire, the cessation of such fire is no indication that they are incapable of further action. Japanese batteries are reported to have frequently misled their opponents by increasing their rate of fire when under effective hostile fire thus inducing their opponent to sense mal-adjustment and search another locality or they deliberately abandoned their guns and took shelter until the storm ceased. In general, therefore, in open field battles the artillery duel of the past is a thing of the past and with modern matériel would generally be a waste of ammunition. In the preliminary stages of aggressive combat, therefore, the artillery fire will probably be limited to sudden and intermittent attacks on likely observing stations; long range firing on hostile troops seeking to get into position, and attacks upon those parts of the enemy's force which seek to oppose the action of our infantry in getting in position. It is now an established principle that in open field warfare the infantry cannot withhold its attack awaiting the result of any preliminary artillery combat, its advance must commence shortly after or be simultaneous with the opening of fire by the friendly artillery, for generally it is only by so advancing that the enemy's artillery will disclose itself. Therefore, until our infantry comes within effective small arms fire, the principal target of our artillery will be such hostile artillery as opens up on our troops with probably some fire to breach obstacles, or discourage work on hostile trenches.

As the progressive advance of our infantry brings them within effective rifle fire, more attention must be paid to the hostile infantry to secure our fire superiority. It thus results that the counter batteries acting from masked positions must dominate the enemy's artillery with the greatest possible rapidity; the infantry (breeching) batteries taking, frequently, on account of their more varied rôle, a less defilade than the counter batteries, open upon the hostile infantry and obstacles. The designation of batteries as counter or infantry batteries is not permanent, and may vary with the progress of the engagement.

This in general constitutes the *preparatory stage or preparation for the infantry attack*, but goes on simultaneously with the infantry advance.

Before opening fire with any unit of artillery on any objective, care must be taken to have at hand another unit ready to open upon any of the enemy's artillery which may attempt to prevent the first unit from accomplishing its mission by forcing it to cease firing.

In order to have batteries available for this counter-attack economy of forces must be practiced; no greater force must be used at first than is absolutely necessary. (F. A. D. R., Par. 1684)

Thus the fire of the field artillery will gradually increase in the frequency and volume of its squalls as battery after battery is drawn into action and opportunities for effective fire increase in number, while the combat gradually progresses to what may be called a decisive stage.

In the decisive action, a special preparation is necessary. The most rapid and intense concentration of fire of all the available artillery is brought to bear upon the objective against which the infantry is advancing.

During this special preparation the counter batteries continue or resume their fire on the hostile artillery, and some of the infantry batteries may be sent forward if conditions warrant the change of position.

As our attacking infantry reaches the danger zone of our artillery, the commander of the infantry firing line should, by preconcerted signal, such as the display at the firing line of a conspicuous and suitable flag, inform the artillery commander of the fact. The artillery then increases its range so as to impede the movement forward of possible hostile reserves, and to take the enemy in rear in case he retreats.

The third and last phase of the attack consists in securing the victory, or in averting disaster in case the attack is a failure.

When the third phase of the attack is reached, accompanying batteries will be designated from the infantry batteries, whose mission will be to reach the captured position as soon as possible after the infantry, in order to pursue with their fire the retreating enemy and to aid in repulsing any offensive return. They should cover with their fire the advance of troops which may be pushing on in pursuit, and break down all efforts of the enemy to reform and renew the fight.

In case of reverse, artillery directs upon the enemy's attacking troops every gun which can be brought to bear, in order to destroy their morale and to assist the repulsed troops in the renewed effort which may lead to victory. If the repulsed troops continue to be forced back, the artillery

must cover their withdrawal, resisting the advance of the enemy, if necessary, until annihilated. (F. A. D. R., Pars. 1687-88 inclusive)

Where the hostile troops are well entrenched it may be necessary to subject their lines to a powerful and long sustained bombardment before the infantry can be sent forward with any hope of success.

The Defense: The preliminary reconnaissance should be as exhaustive as time will permit that the most skillful utilization of the ground may be secured and communications perfected. The sectors of fire should be registered or ranges secured to prominent features therein. In many cases, especially when the direction of attack cannot be definitely foreseen it may be advisable to have the field artillery in readiness until the attack develops. This will more easily insure occupation of positions with a correct front and serve to prevent subsequent changes of position. Positions may be artificially strengthened by the use of intrenchments, screens, and obstacles. A large supply of ammunition should be close at hand and generally every effort made to neutralize the probable artillery superiority of the enemy by skillful use of the ground and greater fire efficiency both in accuracy, rapidity, and volume. The advantages of covering dead space in front of the defense by flanking fire must not be overlooked.

The commander of the troops should generally give the order for opening fire; premature opening of fire, firing at excessive ranges, and fire upon small hostile detachments should be avoided.

As a rule the action will be commenced by engaging the assailant's artillery if it is doing effective work and, as a rule, it will be necessary to employ the whole of the defenders artillery to attain superiority. The commander of the forces gives general instructions for resisting the infantry attack.

* * * * * When the enemy's infantry advances to the attack, the artillery must make them their target, regardless of the enemy's artillery fire, if necessary leaving cover for this purpose. If possible, the enemy's batteries should at the same time be held in check, but the repulse of the infantry attack must remain the most important feature.

If, before the infantry attack even commences, the enemy's artillery proves itself so superior that it appears hopeless to continue the artillery

action, the batteries may temporarily seek cover from the enemy's fire. But as soon as the enemy institutes the decisive attack every gun must at once, even without particular orders, resume the struggle and engage the enemy's infantry only, heedless of his artillery fire. A few batteries, even single ones, thrown into the struggle at fresh unexpected points may be of especial use at this juncture.

If, nevertheless, the attack succeeds, part of the artillery must prevent the advance of hostile batteries into the captured position, part must concentrate its fire upon the hostile infantry which has penetrated, and, in coöperation with the reserves, expel the enemy from the captured position. This is one of the tactical situations in which steadfast endurance to the last is imperative, and even if it lead to the loss of the guns, is in the highest degree honorable. (F. A. D. R., Pars. 1692-98)

If a stubborn resistance is intended a limited number of batteries may be posted in general, close to the firing line thoroughly protected from front and reverse fire by natural or artificial cover so as to sweep the front of the defense at close range. These batteries should generally refrain from disclosing their presence until the attack reaches the decisive stage when they can be employed to great advantage by enfilade fire along the front. As they will generally be posted close to the front, the chances are that they will be unable to withdraw if the defenders are forced out of position. For convenience of reference batteries so posted may be called "stabbing" batteries or "dagger" batteries in contradistinction to the "sword" batteries of the bulk of the artillery posted further in rear of the infantry firing line for long range fire.

Advance Guard Actions: The tactics of a protective advance guard are such as to secure delay. An initial offensive movement often secures the best results and the guns should be handled boldly. "Bluff, not slaughter, is the object in view." The artillery with an offensive advance guard should be handled in the same way as when with any other force on the offensive.

The action of field artillery with an advance guard will vary with the object the advance guard has in view. It should not occupy positions from which it cannot be withdrawn without a general engagement, perhaps not intended by the commander of the force. Its main duties are to break down any resistance to the advance of the other arms, or to cover their retirement if necessary.

Positions with as much cover as possible should be chosen, with preservation of complete freedom of maneuver; while the guns themselves should be placed at large intervals, and used with great rapidity of fire, so as

to deceive the enemy, if possible, as to the strength of the force opposed to him. (F. A. D. R., Par. 1679)

Rear Guard Actions:

As the principal duty of a rear guard is to gain time, and as it should be able to withdraw without serious loss, positions should be selected so as to utilize the long range of the guns to force the enemy to deploy at the greatest possible distance; such positions must also afford sufficient facilities for withdrawing. In withdrawing, small changes of position should be avoided, the retirements from one position to another being over as great a distance as is consistent with delaying the enemy to the utmost. (F. A. D. R., Par. 1694)

"Infantry when retreating are apt to become disheartened and it is the business of the gunners to keep up their spirits by a close and effective support, undeterred even by the prospect of losing their guns."

Flank Guard Actions: The tactics of the artillery conforms to that of the requirements of the situation and is offensive, defensive, or delaying as the case may be.

Horse Artillery in a Cavalry Action: In large commands there may be time for the formulation of a definite decision and regular issuance of orders for combat by the commander of the troops, but often there will be no time for consultation between cavalry and artillery commanders, and the latter will receive only very brief and general instructions, if any at all. It is needless to say both commanders must have great quickness, decision, and tactical instinct for successful coöperation. Rapidity of decision on the part of the artillery commander, accuracy and rapidity of fire on the part of the personnel, and mobility as regards the guns—these are the essentials toward horse artillery success in the opinion of Lord Roberts.

When cavalry meets cavalry, both being mounted, the following principles should govern the horse artillery commander:

(a) The position for the guns should be chosen with a view to obtaining the most effective fire on the enemy's cavalry previous to the cavalry charge and to covering with effective fire the area over which our charge is to be made.

(b) The position chosen should permit the fire of the guns to be delivered up to the moment of collision and should not hamper in any way the movement of our cavalry.

(c) Long-range firing at the enemy's guns is to be avoided.

(d) While the opposing cavalry is the most important target, if the enemy's artillery is inflicting losses on our cavalry, it will be necessary to

assign batteries to hold them in check. When the fire of our guns becomes masked by the movement of our cavalry, they may all be turned upon the enemy's artillery.

(e) If the charge succeeds, the horse artillery should advance as soon as possible; if it fails, the guns should form a rallying point for the cavalry, which should invariably rally in rear of a flank and not fall back directly on the guns.

(f) In the mounted combat and in the pursuit by horse artillery, indirect laying has no place. * * * * * (F. A. D. R., Par. 1700)

All cavalry combats will in general fall into one or the other of the following three classes.

(a) A rapid advance of the cavalry command for the seizure of an important position. In this case, as quickly as the cavalry advance guard has gained the position, the batteries should push forward at a rapid gait and establish themselves for its defense. The artillery reconnaissance details with the cavalry advance guard should be sufficiently numerous to cause no delay in the selection of positions and in guiding the batteries thereto.

(b) When cavalry meets cavalry and a mounted combat is imminent. In this case the cavalry will generally deploy front into line and the artillery commander will generally have to decide upon which flank or flanks to post his command and the command must be moved thereto with the utmost rapidity. The decision as to the place to unlimber is also an important one. If not properly selected, the advance of the friendly cavalry may mask the fire of the guns too soon. If the cavalry deployment is toward a flank of the march column the same important decision as to the proper flank of the deployed line on which to post the guns, may rest with the artillery commander. It is complicated in this case by the danger of interference with the cavalry units moving to position.

(c) When the cavalry dismounts to fight on foot the same general principles apply as in acting with infantry. The extent of front is likely to be much greater, leading to a great dispersion of the horse artillery units. Indirect laying may be employed, provided it does not cause delay.

CHAPTER XVIII

AMMUNITION SUPPLY

General method of supply: Ammunition is supplied to field artillery in campaign in the following manner:

(a) The caissons of the gun sections are replenished from the fifth section caissons. The latter are replenished from the caissons of the battery combat train.

(b) Combat trains are replenished from the ammunition trains, which in turn are refilled from the ammunition column. In exceptional cases issues are made direct to combat trains.

(c) Ammunition columns are supplied from ammunition depots at the base of operations. For this service the commander of the lines of communication is responsible.

Base ammunition depots are supplied from arsenals.

The organization and operation of the divisional ammunition service is the duty of the Field Artillery. Artillery officers must, therefore, understand the principles governing the supply of small-arms ammunition as well as of Artillery ammunition and must study the dispositions suitable for the supply of the different arms in action. The principles are set forth in Field Service Regulations. Sound judgment in making suitable dispositions is to be acquired through the study of that part of the regulations of the several arms relating to combat and through the solution of tactical problems involving ammunition supply. (F. A. D. R., Par. 1708)

The present F. S. R. prescribe the organization of the *divisional ammunition train*. It consists of a major commanding with a staff of one lieutenant, four N. C. O. agents, and two orderlies detailed from the division and two *ammunition companies*, each commanded by a captain with one lieutenant, eight agents, and eleven privates as assistants all detailed from the division. Each ammunition company consists of three wagon companies (27 wagons each) with Q. M. corps personnel, or the equivalent of this transportation in motor truck organizations.

As to the total amount to be supplied the following table shows the number of rounds per piece for the various calibres and their location.

Location	Rounds per piece			
	8" gun	8" Howtz.	8".8 Howtz.	4".7 Howtz.
With the firing battery.....	190	170	} 168	} 90
With the battery combat train	168	170		
With the ammunition train..	106	120	144	90
At the advance supply depot	464	290	312	180
<hr/>				
Total at the front.....	928	480	624	360
At the base or in arsenals convenient thereto.....	928	480	624	360
<hr/>				
Total in the theatre of war	1856	960	1248	720

Horse artillery operating with cavalry divisions is not usually accompanied with ammunition trains, but replenishes its supply from the nearest division. The limbers of horse batteries are not, as a rule, filled with ammunition.

Position of combat trains and of ammunition trains: On the march the battery combat trains march either with their batteries, united in rear of their battalions or regiments, or united in rear of the column. In action the combat trains are generally assembled by battalion and are posted about six hundred yards in rear of the artillery line of battle.

When action is imminent the ammunition train marches, as a rule, in rear of the main body. At the beginning of an engagement the artillery ammunition train is directed by the commander of the division to proceed to some suitable location from which practicable routes radiate to the firing batteries. It then passes to the control of the senior artillery commander. As a rule the most suitable preliminary location is found at a distance of from two to three miles in rear of the line of firing batteries. Inasmuch as the expenditure of ammunition will not be the same for all the batteries, it is, as a rule, desirable to hold the ammunition train together during the earlier stages of the engagement. As the probable course of the engagement becomes known it may be advisable to subdivide the ammunition train and station the subdivisions at such places as will facilitate the supply of the battalion combat trains.

CHAPTER XIX

PROTECTION FROM FIELD ARTILLERY FIRE

This is a subject of vital importance to infantry and cavalry troops.

When within 8,000 yards of hostile troops having heavy field artillery close order movements in the open are dangerous. If the enemy has only light field artillery, this distance may be reduced to 5,000 yards. Inside of 3,500 yards field artillery fire delivered against bodies of troops in close order is likely to be almost annihilating. At most of our maneuvers, troops almost habitually continue on the roads in march formation until the zone of small arms fire is reached irrespective of whether or not the opposing troops are provided with artillery. This is not simulating war conditions. The following is from "Actual Experiences in War," Captain L. Z. Soloviev, 34th East Siberian Rifles.

MOVEMENTS IN THE ZONE OF ARTILLERY FIRE

In present day battles the artillery strikes at a distance of 5 or 6 versts (5,833 to 7,000 yards). Artillery combat is generally taking place at such distances, and infantry units are hit only accidentally, but should large units be discovered at that range it is certain that Japanese artillery will not lose the opportunity and that the column will come under artillery fire, and very well aimed fire at that. * * * * *

The movements of infantry at a distance of 5 to 3 versts (5,833 to 3,500 yards) are generally effected in marching columns by sections or by lines.

But already at 3 versts (3,500 yards) range the fire of artillery grows effective and the shells tell often, especially on open terrain. Thus arises the question: what order shall be adopted for these movements?

These movements are effected in Manchuria by marching in platoon columns so as to avoid great extension. It is impossible to march with a wide front, for there is no room and it is impossible to use company formations. The troops move, endeavoring to cover themselves by the hills keeping to the inner side of these as in rear of breastworks, but well-aimed shrapnel may still cause great havoc to the lines. The best provision for security on the march is secrecy.

But as soon as the troops emerge upon open terrain, movements not only in column formations but even in deployed order, are absolutely impossible, taking into consideration the striking accuracy of modern artillery.

Troops arriving from Russia often paid a high price for their ignorance of the formation taken by Serbian troops for infantry movements under

artillery fire on open terrain. It sometimes happens that troops under fire neglect to abide by this rule, but a severe chastisement invariably ensues.

I witnessed the following at Mukden on September 28:

A battalion of "N" Rifles Regiment was to replace our regiment in our position while we were designated for the attack. It was still light, about 5 p. m., and the fire on both our side and that of the Japanese had slackened. I began to scan the neighborhood through my field glasses and saw suddenly most clearly and distinctly a column emerging some $1\frac{1}{2}$ versts (1750 yards) in the rear of us. It advanced slowly from behind a hill in column formation, by sections, to a wide, open plain of harvested kaoliang. The column was marching in excellent order according to peace time regulations: In front rode the commander of the battalion, followed by his adjutant, in rear of whom rode the commander of the leading company, while behind him marched the lines of the men. Suddenly something unimaginable took place—something which awed even those who were accustomed to battle.

It must be said that some half hour before, a Japanese battery, stationed in front of us, left its position and took up another position opposite our flank. We could see this change of position very well from our hill and for several minutes we took advantage to open a fierce fire against the Japanese. The battery soon disappeared and opened no fire.

We had forgotten all about it. But it had noticed from a distance the column coming up to us, and hid and waited.

As soon as the first company emerged on the plain and had shown itself as on the flat of the hand, it was suddenly encircled with the smoke of shrapnel explosions as with a mist. We could see clearly how the projectiles burst in the very center of the column, dispersing the men; how they surrounded it as with a circlet of flames; how they exploded right in front of the column, in the very faces of the men; and how, as the troops advance, the projectiles shifted, not losing aim for an instant. For some minutes the column marched through the smoke, but as soon as it disappeared in rear of a hill the fire ceased. But a long row of black, immobile figures was left behind. The fire lasted some five or six minutes, and we counted approximately some 60 shrapnel fired at the men.

The following companies proceeded at a run, according to the generally adopted formation, and arrived safe.

War is terrible, through the fact that every mistake, every error, brings about immediate punishment and often very severe chastisement.

The presence of, and movement of infantry within the zone of effective artillery fire is unavoidable, therefore, expedients to minimize its effect are to be sought.

For purposes of discussion these expedients may be grouped as follows: Those which *increase the difficulties of adjustment of the hostile fire and those which diminish the actual effect of adjusted fire or attempts at avoiding or neutralizing fire for effect.*

Under the first, the most important are concealment and secrecy of movement. Troops should never be halted in the

open, but habitually defiladed from the hostile positions by groves, hedges, buildings, standing grain, and irregularities of the ground, kneeling or lying down if necessary to secure more complete defilade. This defilade or concealment should be secured not only from probable hostile artillery *positions* but from likely *observing points* which the enemy may occupy such as hillocks, towers, and tall trees. Similarly, entrenchments should, if possible, be so located that they are similarly defiladed. In general, however, other considerations prohibit such defilade and recourse must be had to masks, disguises, and dummy trenches. In locating trenches or concealing bodies of troops behind masks or in constructing masks it should be borne in mind that it is easy as a rule for artillery to adjust its fire on the mask itself, but that it is difficult to determine the distance from the mask to the vulnerable point in rear. Therefore the area to be searched by the hostile fire may be increased by increasing the distance between the mask and the formation it is sheltering. By making the mask oblique to the position the difficulty of adjustment upon the mask is increased and by varying the distance from mask to target, accurate adjustment upon the target is rendered almost impossible. All modern shrapnel is fused with percussion fuse, which explodes the shrapnel upon impact with light material objects such as tree trunks, limbs, and even large twigs. Therefore, masks such as a row of trees may cause premature burst of hostile shrapnel and afford even better protection than trenches, but the target should not be closer to the mask than 300 to 400 yards. Concealment from aerial observation in open country is almost impossible for large bodies of troops. The true defense in this case must lie with the friendly aerial service and the anti-aircraft batteries.

Troops should not be posted in the vicinity of conspicuous objects, such as lone trees, clumps of bushes, etc., which will greatly facilitate adjustment and which may be hostile registration marks. Advance skirmishers should notify the troops of conspicuous objects which show signs of hostile fire for registration. Fresh entrenchments should be disguised by sod, brush, snow, etc., so as to conform to the landscape.

In general it is more difficult for field artillery to adjust upon moving targets than stationary ones and the difficulty increases with the rapidity of movement of the target. It is also more difficult to adjust upon targets moving obliquely to the line of fire than those moving directly to a flank or directly forward or rearward in the line of fire. Accurate *range* adjustment is generally more difficult to secure than *lateral* adjustment. In general, therefore, troops should change position in the open by rapid movements or rushes on a path, *oblique* to the direction of fire.

A knowledge of the methods used by artillery in securing adjustment will always be of service to troops seeking to increase its difficulty. Hostile artillery fire in the nature of *single shots at intervals, platoon or battery salvos* generally will indicate that hostile artillery is firing for adjustment. Big jumps in the range, direction, or height of burst of the projectiles will generally be proof conclusive that he is in the adjustment stage and will generally indicate the particular target upon which he is trying to adjust. A sudden rapid movement of this target is sure to increase the difficulty of adjustment and perhaps prevent accurate adjustment before the target reaches a place of safety.

Thus a salvo suddenly fired at a stationary target and falling short of this target is generally indicative of fire adjustment because it was a salvo. Another salvo at an increased range is almost certain to follow, therefore the proper thing to do under the data available for an estimation of the situation would be for the target to move rapidly to the point of fall of this first salvo, for unless the hostile artillery failed entirely to sense this salvo the next one will be a salvo with a material change in the gun laying data. If they fail to sense the salvo, the next one is liable to be a repetition of the first and the shots will cover the same area. The target can in a measure arrive at a decision in this respect also by observing whether or not the salvo fell on ground generally observable from the hostile positions or whether it was a salvo of low burst and impacts falling upon a reverse slope or into a hollow obscured

from the enemy's view. Should the salvo be an "over" the target can generally conclude that the next fire will be a salvo with reduced range and can act accordingly.

In regard to neutralizing or avoiding fire for effect, *concealment* and *shelter* may be considered first. *Concealment* generally implies the idea that while it is physically possible for the hostile projectiles to reach the target, the latter is hidden from his observation. As before stated the *modus operandi* of field artillery is to adjust upon the mask and search the probable area behind it. The limitations of ammunition supply restrict recourse to this class of fire. For similar reasons the area to be searched must be of limited extent. If searching is apprehended then the target should put itself in that part of the territory behind the mask most unlikely to be searched, and some decision in this respect can be reached by estimation of the situation from the enemy's point of view and a consideration of what he may know of the territory behind the mask.

In general the target should be as far in rear of the mask as is possible (not closer than 400 yards) and prepared for rapid movement to front, rear, and flanks. The searching may be conducted in one or two general ways—the entire width of the area may be covered by sweeping or by increasing the number of guns firing on the front and in depth by a "walk through" in which the range is increased by an increment after each sweep or volley along its front, until the depth limit is reached. This walk through may be made backward, that is, beginning at the extreme range limit of the area and decreasing the range after each lateral search. On the other hand the area may be searched by successive "walk throughs" with reduced fronts. If a single battery is doing the searching and follows any of the systematic methods in regular order, a small target might avoid the path of the fire squall, but if the single battery adopted a combination of the two general methods or "checkerboarded" the area so to speak which is easy to do, or if two or more batteries were searching simultaneously their respective sections of the area, it is doubtful if a target of any size could sense the system in time to avoid

it by movement. Security is of course more assured if the target can escape into a part of the area already searched after the fire begins. It is unnecessary to add that this fire is practically annihilating to targets subjected to it without shelter, and that if "searching an area" is decided upon, it will be done systematically and effectively within the limits of the rectangle searched. A battery using parallel fire (covering its own front) in four volleys, each fired with a successive range increment of 100 yards searches an area of five or six hundred yards in depth and one hundred yards wide.

Shelter against shrapnel fire is secured by interposing obstacles between the source of fire and the target which stops or so reduces the velocity of the individual bullets that they are harmless.

The shrapnel bullet is spherical and upon leaving the case has the remaining velocity of the projectile itself plus the velocity added to this by the bursting charge. The muzzle velocity of the projectile is 1700 feet per second. This velocity falls to 1000 feet per second at 2000 yards, and to 780 feet at 5000 yards. The velocity imparted by the bursting charge is about 200 feet per second. Therefore the velocity of the individual shrapnel bullet upon burst runs from 1200 feet per second at 2000 yards range to 980 feet per second at 5000 yards. These bullets are effective (have killing energy) against man and horse at distances varying from 220 to 175 yards from the point of burst between these ranges (2000-5000 yards). The efficiency of the shrapnel bullet is, therefore, not comparable to a modern rifle bullet but more to that of a 45 calibre pistol, and the necessary thickness and character of shelter may be gauged accordingly. Plank, boards, canvas, or brush with a few inches of earth thereon, tree trunks, etc., will generally constitute effective shelter from the shrapnel bullet.

As to the danger space of the shrapnel bullet: To the angle of fall at any given range must be added the angle of opening made by the bullets in the lowermost element of the cone of dispersion. The angle of fall increases with the range, also the angle of the opening of the shrapnel. The following

table shows the angle of fall of the bullets in the lowermost element of the shrapnel cone for several ranges. (Three inch gun.)

Range	Angle of Fall	Slope of Fall
2000 yards	11° 13'	1 on 5
3000 do	15° 32'	1 on 3.6
4000 do	20° 28'	1 on 2.7
4500 do	23° 20'	1 on 2.3

At the given ranges, therefore, reverse slopes having less than the tabulated slope can be swept by shrapnel fire and shelter for men lying down can be secured only on ground more steep. For men standing, animals, and mounted men the declivity must be correspondingly increased.

In advancing across open ground subject to hostile shrapnel fire, the particular formation adopted by the infantry is purely an infantry problem, the proper solution of which must be based on a study of the effect of artillery projectiles and artillery fire tactics.

The Infantry Drill Regulations on this subject read as follows:

453. The firing line must ordinarily advance a long distance before it is justified in opening fire. It can not combat the enemy's artillery, and it is at a disadvantage if it combats the defender's long range rifle fire. Hence it ignores both and, by taking full advantage of cover and of the discipline of the troops, advances to a first firing position at the shortest range possible.

Formations for crossing this zone with the minimum loss are considered in paragraphs 212 to 220, inclusive. These and other methods of crossing such zones should be studied and practiced.

454. The best protection against loss while advancing is to escape the enemy's view.

The paragraphs mentioned refer to the specific formations known as *squad* and *platoon columns* and an advance in a *succession of thin lines*. The same drill book also goes on to say:

220. The above are suggestions. Other and better formations may be devised to fit particular cases. The best formation is the one that advances the line farthest with the least loss of men, time, and control.

Squad and platoon columns were used during the Franco-German war and thin successive skirmish lines during the Russo-Japanese war with considerable success.

The present German Drill Regulations advocate a checker-board or echeloned formation of the various squad or platoon columns. It has been suggested that a formal command for taking up such a formation might well be incorporated in the infantry drill regulations.

Target movements to increase the difficulty of hostile adjustment have been mentioned. It should be remembered that adjusting fire against stationary targets is usually by single shots, or platoon or battery salvos, and that large changes in the hostile gun laying data may be expected in the adjusting salvos, these changes diminishing in quantity as the hostile artillerist reduces his range bracket and deflection errors. Fire both for adjustment and for effect against moving targets will habitually be by *volley* and will usually constitute a "walk through," forward or backward by successive changes of the range with or without sweeping at each range, as quickly as the long bracket (600 yards) is obtained.

The shrapnel bullet loses most of its effectiveness against the new infantry pack when the latter is filled. Troops so equipped unable to escape a *rafale* will then secure the maximum amount of protection by halting and sitting down with their backs to the direction of fire, until the squall has passed over them.

It is virtually impossible to prescribe any *rule* for infantry formations in crossing open ground exposed to observed artillery fire.

The *general principle* is to *reduce time of exposure* to a *minimum*, and during exposure adopt such formations as will *delay adjustment*, *minimize effective hits*, and induce the enemy to expend *as much ammunition as possible without corresponding results*.

CHAPTER XX

FIELD ARTILLERY SUPPORTS

"It is under cover of the artillery that the other arms advance and they in turn guarantee its security." (French Regulations)

It is the duty of field artillery to provide for its own security when such security is not provided by the other arms. With

open ground and no dead spaces within its immediate front, a battery can defend its own front without trouble. The personnel are armed only with the pistol, hence an attack from the flank or rear is likely to result in capture of the organization. The limbers and combat trains when detached are particularly vulnerable as there are rarely any artillerymen present with them except the drivers whose attention is taken up with their teams.

The security of Field Artillery on the march or in combat must be provided for either by the distribution of the other arms or by bodies of Infantry or Cavalry, called Artillery supports, specifically detailed for the purpose. When such is not the case the necessary protection must be furnished by the nearest unit whose mission will permit.

The Artillery commander takes general measures to insure the support of the Field Artillery. Subordinate commanders, by the suitable disposition of Artillery scouts, supplement his arrangements or, if security is not provided by the other arms, provide for early warning against surprise or attack.

When operating with Infantry the detail of a support is not necessary except when the Artillery is separated from the main body or occupies a position in which its flanks are exposed. The detail of a special support is to be avoided whenever possible. (F. A. D. R., Pars. 1719-1721)

The F. S. R. say:

Par. 161. *Night Marches:* * * * * * If cavalry forms a part of the column at night, it ordinarily marches in rear of the infantry; if there is artillery, it generally follows the cavalry and *has a special infantry escort.*

Par 102. *Marches in the Presence of the Enemy:* During the advance, the artillery, in order to expedite its entry into action, is generally near the head of the main body, *sufficient infantry leading to insure proper security.* * * * * * If there is danger in the flanks * * * * * the artillery may be broken into columns not longer than a regiment; it then marches like a convoy with infantry in front, in or opposite the center, and at the rear.

Par. 60. *Preparatory Stage:* * * * * * Supports to feed the firing lines follow under cover as near the lines as possible, and *local reserves are held at suitable points to defeat possible counter attacks of the enemy.*

The Infantry Drill Regulations on the subject are as follows:

579. The purpose of artillery supports is to guard the artillery against surprise or attack.

Artillery on the march or in action is ordinarily so placed as to be amply protected by the infantry. Infantry always protects artillery in its neighborhood.

580. The detail of a support is not necessary except when the artillery is separated from the main body or occupies a position in which its flanks are not protected.

The detail of a special support will be avoided whenever possible.

581. The formation of an artillery support depends upon circumstances. On the march it may often be necessary to provide advance, flank and rear protection. The country must be thoroughly reconnoitered by patrols within long rifle range.

582. In action, the formation and location of the support must be such as to gain and give timely information of the enemy's approach and to offer actual resistance to the enemy beyond effective rifle range of the artillery's flanks. It should not be close enough to the artillery to suffer from fire directed at the artillery. In most cases a position somewhat to the flank and rear best fulfills these conditions.

583. The support commander is charged only with the protection of the artillery. The tactical employment of each arm rests with its commander. The two should cooperate.

The security of field artillery on the march was considered in the chapter on "Position in Column." The substance of the above regulations and of the discussion in that chapter regarding its security when in column of route are based on a consideration of its vulnerability when in column of route, and the conclusion is that cavalry or infantry must march in sufficient proximity to the field artillery to insure to it the protection of their rifles in case of sudden attack. The F. S. R., page 102 above quoted, fix the maximum length of a solid artillery column under such circumstances as that of a regiment (in section column less its combat train) which is about 1350 yards. This should be reduced still more by sandwiching troops armed with the rifle into the artillery column at *less* distances if the nature of the country would render its effective support impossible, in case of sudden attack. The ability to get rifle fire upon any threatened point of attack is the guide for a solution to this problem and this is largely governed by the nature of the terrain and the activity of the enemy. It should be remembered that a long column of artillery in route formation would prove a tempting bait to bodies of hostile cavalry and would be likely to draw fire from any hostile infantry within rifle range. Therefore, troops armed with the rifle should be so placed in the column as to be able to resist such attacks.

Paragraphs 580 and 582, Infantry Drill Regulations, cover very completely the subject of support for field artillery during

combat in coöperation with infantry. In general the detail of a special support for artillery operating with infantry is unnecessary, due to the presence of infantry reserves, both local and general, and to the ordinary precautions taken by the commander of the troops to guard against counter attacks of the enemy and hostile cavalry operations in his rear. Artillery in any position on the battlefield where it is liable to attack or surprise by hostile troops before friendly troops armed with the rifle can come to its support should be assigned a special support or otherwise specially provided for, as there is not only the danger of its capture but the more dangerous eventuality of its fire being interfered with at a critical phase of the combat.

In the case of artillery operating with cavalry in dismounted action the situation is generally the same as when operating with infantry, but if the cavalry command be much dispersed, as may be frequently the case in dismounted action and particularly if its opponent be cavalry, particular care must be taken to see that the field artillery is not left in positions where it may be surprised by the hostile troops. In mounted combat the field artillery will almost habitually seek a position on the flank; and thus is almost invariably exposed, at least on one of its flanks. Furthermore, the phases of mounted combat will generally change so rapidly that field artillery amply protected one moment may be left totally exposed the next, hence it is almost an invariable rule to *assign a support to the artillery operating with cavalry in mounted combat*. In action, the formation and location of the support is a matter of cavalry or infantry tactics. It should be such as to gain and give timely information of the enemy's approach and to offer actual resistance to the enemy beyond effective rifle range of the artillery's flanks. It should not be close enough to the artillery to suffer from fire directed at the artillery. The consensus of cavalry opinion is, that a cavalry support should *fight dismounted*, as it is too liable to be led off, or enticed off, and fail to fulfill its mission, if it fights mounted. There may be cases, as for example a single troop told off to support

a battalion of field artillery where the batteries are somewhat dispersed, and both flanks exposed in which it would be desirable to hold the support mounted in a central position ready to move rapidly to the threatened flank, but once there the actual combat should generally be dismounted Par. 583, Infantry Drill Regulations, likewise applies to cavalry supports.

"The support commander is charged only with the protection of the artillery. The tactical employment of each arm rests with its commander. The two should cooperate."

Support commanders of both infantry and cavalry should inform the artillery commander of their general dispositions and give him timely advice of hostile movements in their direction. *The decision to abandon the position or to change position should rest with the field artillery commander*, the support conforming to the movements of the artillery.

It should be noted that the infantry regulations advise a position for the support to the flank and rear. There are numerous historical examples in which this rule has been violated with disastrous result and the following is interesting as showing the unfortunate results of a practice which it would seem was, at the time very general though one that very little thought or common sense ought to condemn. It also applies to that rule of cavalry combat, which is to the effect that if the charge fails, the gun should form a rallying point, the rallying being invariably effected in rear of a flank of the guns, and not where it will mask their fire. The following is taken from the report of Lieutenant Randol, commanding Battery E, 1st U. S. Artillery, regarding an action near New Market, Virginia, in which his battery participated June 28, 1862:

"Early in the engagement I had cautioned both officers and men of my supports that if they charged in front of the battery and were obliged to fall back, they should at once unmask my fire by returning by the flanks of the battery. They rushed boldly to the charge, confident of an easy victory, but being met by a fresh regiment, the third of the column of attack, they fired once, were seized by unaccountable panic and fled, threw away their arms, and rushed directly for the battery. I in vain endeavored to make them unmask my fire. On they came, the foe close behind them, till when within 80 yards I gave the command to fire; but it was too late, they rushed through the battery, followed by nearly 50 of the enemy. When our troops broke I ordered the pieces to be limbered to the rear, but 88 of my horses lay dead on the field and many were badly wounded."

General Hunt, Chief of Artillery of McClellan's army, endorsed this report as follows:

"The loss of Randol's guns and the success of the enemy's charge might have been prevented but for an error, so common and so deeply rooted as to require special instructions from headquarters to correct it. It appears that the column of attack on the battery consisted of three regiments in line. The two first were repulsed. The second repulse was followed up by a charge from the supports of the battery. Immediately on meeting the third regiment of the assaulting column the support broke and sought shelter in the battery, closely pursued by the enemy who entered with them. Had they returned, as urged and warned beforehand to do, by the flanks of the battery, thus leaving its field of fire clear, the third assault might have been repulsed and the guns saved; but, as is usual the supports had in the first place taken up their position in the rear of the guns, amongst the carriages, where they could by no possibility be of use except to repel an attack with the bayonet, and from which position they are almost always sure to fire through the battery. When in this case the supports were repulsed in this sortie they rushed through the battery for their former positions, depriving the artillery of the power of self defense.

"I have always found it difficult to get infantry troops ordered to support batteries to take positions on the flanks. They insist upon being either in front or rear of the batteries. Generally the commanders of these supports rank battery commanders, and the latter are unable to correct the evil. It is desirable that the artillery officers should always be consulted as to the positions to be occupied by their supports. If this is not done, it would be better in most cases to give them no special support, but leave them to the chance assistance of troops in their neighborhood. Lieutenant Randol's guns were well defended by the gunners, and their loss reflects no discredit on either men or officers." (Civil War Records, Vol. XI, Series I)

The mounting of infantry supports upon the artillery carriages is a proceeding of doubtful value. This is frequently done in solutions of map problems and not infrequently at maneuvers. A little consideration will often show that little is gained by it in the long run. There are places for seating some 17 men on a gun section counting the off horses. Allotting five of these to the cannoneers, twelve seats remain for the foot soldiers, or six per team. As these men with equipment will weigh over 200 pounds each, some 1200 pounds is added to the weight behind each team and rapid movements could be executed only with difficulty and at the expense of quickly exhausting the teams. Only grave emergencies should warrant this procedure.

CHAPTER XXI

MISCELLANEOUS

UMPIRING FIELD ARTILLERY

Officers of the other arms are frequently called upon to umpire the work of field artillery at maneuvers and the following suggestions are offered for their guidance in this work:

Senior artillery commander.

(1) Was he present with the commander of the troops at proper times; did he make any recommendations as to the disposition of his troops and were his recommendations considered by the commander of the troops?

(2) When absent, was a field artillery representative left with the commander of the troops; was proper communication established between the senior artillery commander and the commander of the troops?

(3) Was he informed completely of the tactical situation and the plans and intentions of the commander of the troops and subsequent changes in the same?

(4) Were the orders given to the field artillery by the commander of the troops sufficient and complete for thorough coöperation on the part of the field artillery?

(5) Were his orders to his subordinates sufficiently complete to insure their proper action and was the tactical situation and plans of the commander or so much as was necessary for intelligent coöperation and self-reliant action communicated to the subordinate field artillery commanders.

(6) Did he take advantage of opportunities to push reconnaissance details to the front with advanced units?

(7) Did he make the necessary preliminary reconnaissance before issuing his own orders?

(8) Did he require subordinate artillery commanders to join him on his preliminary reconnaissance?

(9) Was his assignment of combat units to position in accordance with his orders and the requirements of the situation?

(10) Were his arrangements for resupply, security, and communication satisfactory?

Subordinate Commanders:

(1) Did they make the necessary preliminary reconnaissance?

(2) Were their orders and dispositions in accordance with their orders and the tactical situation?

(3) Did they communicate so much of the tactical situation and of the plans and orders of the commander to their subordinates as was necessary for intelligent and efficient coöperation and execution of their mission?

(4) Same as (8), (9), (10), under heading "Senior Artillery Commander."

(5) Were the necessary steps taken to insure coöperation with the infantry units which they were ordered to support?

Commander of Firing Units:

(1) Same as (7), (9), and (10) under the heading of "Senior Artillery Commander" and (2) and (3) under the heading of "Subordinate Commanders."

(2) If masked fire was ordered or required, was the deflade sufficient?

(3) Were aiming points and observing stations satisfactory?

(4) Were units exposed to enemy's view in getting into position?

METHODS FOR CHECKING UP THE LAYING OF A GUN

Deflection: The deflection announced for the directing gun of a battery is the angle measured from the target around to the right (clock wise) to the aiming point. This may frequently be roughly estimated and compared with the angle announced by the captain. Estimation is assisted by drawing a rough diagram of the target, aiming point, gun, and B. C. station. Go to the gun and when it is laid prolong the line of sight up over the mask just as a company guide marches on a point. Sometimes the target is visible by standing on the gun or caisson.

If all of these fail, lay off by eye the distance from the target, right or left as the case may be, the displacement of the B. C. station from the gun. Take the compass bearing of this hypothetical target. The compass bearing of the piece when laid should be the same.

Site: If the target is invisible from the gun this can not be readily checked except by verifying the captain's measurements and computations.

Corrector: Can be checked only by firing. Its true value for the occasion is gotten only by observation of fire.

Deflection Difference: Can be checked only by verifying captain's computation if the target is invisible from gun, or by prolonging the line of sight for each gun as in the case of the right piece.

Mask: To ascertain if projectile will clear the mask, if mask is not too distant, have the gun properly laid, then open breech block and sight through the gun; if the line of the bore clears the mask, the projectile probably will. It must clear the mask absolutely. If the projectile passes through trees, bushes, or even high grass, the resistance of same to the flight of the projectile is liable to cause the percussion fuse to act and a premature burst result.

Range: Can be verified in the usual manner, from map, etc.

CAPTURED FIELD ARTILLERY

Hostile field artillery falling into our hands should usually be sent as speedily as possible sufficiently far to the rear to prevent recapture without waiting for orders. As captures will invariably be effected by infantry or cavalry the following should be of interest to officers of those arms. The hostile officers should be immediately separated from their commands, disarmed, and put under guard. The enlisted men should be promptly disarmed, the guns limbered if they are to be immediately removed, and the hostile cannoneers and individually mounted men collected and put under guard separated from the carriages. Any ammunition on the gun carriage itself should be removed. Limber and caisson chests should be locked and the keys collected.

As a further precaution against the mutinous use of the guns, the breechlocks may be removed and carried separately. In forming column, the hostile officers should be separated from the cannoneers and both marched separately from the carriages. The hostile drivers may stay with their teams, all mounted men including drivers should march dismounted. Occasionally it may be necessary to allow the hostile drivers to mount in order to better handle their pairs and also to mount a single hostile cannoneer on each carriage to manipulate the brakes on bad roads. An officer or noncommissioned officer of the friendly troops should be assigned to the command of each battery and such guards and escort as the tactical situation requires. An officer should be assigned to command the convoy as a whole.

To permanently disable a gun, obstruct the barrel with mud, gunny sacks, cotton waste, etc., and fire a high explosive shell in the gun using a long lanyard from cover. This will probably rupture the gun barrel. Letting the oil out of the recoil cylinder and firing the piece will dismount the gun and damage the carriage. The walls of the recoil cylinder are very thin and if dented the injury cannot be repaired on the field. Sights, quadrants, and fire control apparatus may be quickly broken up. Elevating and traversing apparatus and parts of the breech may be disabled by heavy blows. The wheels and poles are usually the only wooden parts of modern artillery and may be burned. The doors of limbers and caissons may be beaten off with a sledge hammer. The gun carriages and limbers and caissons are of steel and may be permanently damaged by firing a high explosive shell into them.

Field artillery may be temporarily immobilized by running off, stampeding, or killing the team animals. The pieces may be temporarily disabled by carrying off the breech blocks and other accessories such as sights and quadrants. Fixed ammunition is difficult to destroy. Firing into a chest of it, with even the high explosive shell, is not likely to explode much of the contents. With a hammer and sharp drift each cartridge case may be punched along the side, or the case ruptured with an ax or hatchet. Single cartridges may be exploded by

throwing them into a fire; this is dangerous and tedious. As quick a way as any, would be to secretly bury it, if deep water is not available in which to dump it.

If our own artillery matériel has to be abandoned it should be immobilized, damaged, or destroyed according to the possibility of our immediately recapturing it.

ARTILLERY HORSES

The work demanded of artillery horses divides them naturally into general classes having material differences:

Scouts, agents, and specialists of field artillery must frequently ride long distances and across country, often at a rapid gait. This requires that they should be mounted and equipped, practically the same as cavalrymen and requires quick, intelligent, sure footed, weight carrying animals. Such horses are described in the specifications for cavalry mounts where it is prescribed that they shall be well bred, of superior class, and have quality, weighing from 950 to 1100 pounds depending on height, which should be from 15 to 15¾ hands. They should have great heart action, courage, and endurance, and be well shaped and well muscled.

The team horse for batteries of light artillery and ammunition trains is primarily a draft horse, and secondarily, a saddle horse, but the fact that the last requirement is secondary does not mean that it is unimportant.

When the carriages are loaded the weight behind each horse in a light field battery is close to 900 pounds and when it is considered that this load must be hauled at times for long hours, in all kinds of weather, over all kinds of ground, and frequently at increased gaits it must be conceded that a horse of superior quality only will stand the strain. In the heavy field artillery, the load behind each animal is about 1000 pounds and the draft horses should all be of the heavy or medium heavy type.

In pairing and teaming the draft horses, the following rules are general:

Horses under seven years to the off side. Horses of the best saddle conformation to the near side. Freer drivers to the off side. Horses of the same pair to have as far as possible the same conformation. The heaviest and strongest horses to the wheel pair.

As far as practicable horses should be accustomed to work in any position.

With the exception of the agents and scouts, the individually mounted men in the batteries should be provided with the same type of horse as is required for the teams. Their duties make no special demands upon their mounts and these should be available for team work when needed. The suitability of the team horse for saddle work should not be overlooked.

THE DEPORT GUN

As some of our own matériel, particularly the three inch, is likely to be modified by the adoption of the principal features of this gun, a few words concerning it are *apropos*.

Our present field gun carriage has three points of support on the ground: the two wheels of the carriage and the end of the trail. The gun barrel has also a limited traverse pivoted on the axle. This lateral traverse is particularly valuable in changing target, in firing at moving targets, and in sweeping fire, as thus, the piece may have its horizontal direction changed without moving the trail. Theoretically this traverse of the gun barrel is limited only to the space between the gun carriage wheels, but with the single trail and the consequent single point of support in rear, the traverse cannot be extended to the wheels but must be limited to much less than this because of the tendency of the carriage to "slew" around when the piece is fired obliquely to the direction of the single trail. Also, the strain brought to bear on the axle, when the gun is fired in an extreme oblique position is liable to rupture the axle unless it is made unduly heavy.

The Deport gun remedies this by having a split or double trail hinged to the gun axle. When limbered, the two halves of the trail are brought together and locked at the lunette end,

forming a single trail. When unlimbered, the two halves are unlocked and each half swung outward until each strikes against the carriage wheel on its side, are lowered to the ground and anchored at the ground end by driving a spike into the earth. This gives two very effective points of support in rear, prevents the slewing of the gun even if it be fired at the extreme limit of its lateral traverse, and takes the oblique strain off the axle. A shoe on each half of the trail clamps the gun carriage wheel and acts as a brake. The angular opening at the axle between the two halves of the trail admits giving the piece greater angles of elevation than is possible with the single trail.

ANTI-AIRCRAFT GUNS

Anti-aircraft Guns: The requisites for such a gun are:

- (a) Quick elevating device for high angles of fire.
- (b) Quick traversing device through a wide angle, preferably all-around traverse.
- (c) High initial velocity.
- (d) Ammunition: Shrapnel or incendiary time shell.

Guns of over 3-inch calibre are therefore not suitable for this purpose.

The 3-inch type of field gun can and has been used for this purpose by mounting the carriage on an improvised turntable with a racer upon which to rest the trail. In an emergency, the light field gun may be so used by simply digging a circular trench about 36 inches deep in which to rest the trail. It is obvious that when the ordinary field gun is to be used for this purpose, *particular units* must be assigned to the duty and cannot well be assigned to other duties at the same time.

Guns with special mounting, designed to fulfill the above requirements and usually with motor transport, are now used abroad for anti-aircraft work. In all cases, a system of lateral observation must be established with sure means of communication for fire control purposes.

Direct laying is used with time shrapnel. Each platoon is fired separately, one beginning at the far limit, the other at the short limit, of an estimated bracket as wide as 2,000 or 3,000 yards. Each fires volleys of one or two rounds at ranges differing by 200 yards, the successive ranges

approaching the center of the bracket. When the bracket has been covered or when lateral observations indicate that the target is out of the bracket the process is repeated. If the range finder is used, a narrower bracket may be attempted. (F. A. D. R., Par. 1412)

Captive balloons are very vulnerable within the limits of the trajectory and the action of the fuse. As they have only a slight motion within narrow limits, they make the best of aerial targets. They are attacked by direct laying with time fire. Dirigibles and aeroplanes readily change their direction, height, and speed, hence rapidity and accuracy in the service of the piece, skillful operation of the range finder, quick decision and command, and boldness in changes of the firing data are essentials of success.

Aeroplanes in particular are difficult targets as, in addition to their mobility, injury to the pilot or damage to engine or fuel tanks is usually necessary to bring them down.

The principal effect of anti-aircraft guns upon dirigibles and aeroplanes is to keep them so high in the air as to nullify or decrease the value of their observation and fighting abilities.

CHAPTER XXII

OPERATION ORDERS

Reference: Three inch Topographical Map, GETTYSBURG-ANTIETAM, BONNEAUVILLE sheet.

SITUATION:

War has been declared between two hostile states, East and West, neither well prepared. The Western army is being formed near CARLISLE the Eastern army near BALTIMORE. The frontier line is the eastern edge of the map herewith. Both sides have a few troops ready to move.

The Western army commander sends forward General A to cover GETTYSBURG and prevent an invasion until he can move the main army forward.

General A's command consists of:

- 1st. infantry brigade (1st., 2nd., and 3rd. regiments)
- 1st. battalion, 1st. field artillery. (light)
- 3rd. squadron, 5th. cavalry.
- Field company "A," signal corps.
- 1st. ambulance company.
- 1 wagon company, artillery ammunition.
- 1 wagon company, infantry ammunition.

General A moved south through GETTYSBURG and out on the HANOVER road by successive marches, camping on the evening of June

2 around BONNEAUVILLE. A hostile detachment which was believed to consist of two regiments of infantry, two batteries of light field artillery and a squadron or less of cavalry was camped the same night just east of LEFEVRE. On the morning of June 3, General A marched on LEFEVRE, via WHITEHALL in the following order of march:

Cavalry, independent.

Advance guard, 2nd. infantry (less 3rd. battalion) distance 800 yards.

Main body in order of march:

3rd battalion, 2nd. infantry.

1st. battalion, 1st. field artillery (less combat trains)

3rd. infantry.

1st. infantry.

Artillery combat trains.

1st. ambulance company.

Company "A," signal corps.

Field and ammunition trains remaining parked at BONNEAUVILLE.

At 6:00 A. M., when the support of the advance guard had reached WHITEHALL, firing was heard to the front and the cavalry reported from east of WHITEHALL, that the enemy was going into position on the 627 hill one-half mile north of PLEASANT HILL S. H. Personal observation by General A and further reports from cavalry and from the advance guard, confirming this, General A at 6:30 A. M. issued the following order at ST. LUKE'S CHURCH to the assembled commanders of infantry regiments, the artillery battalion, signal company and his staff:

The enemy in our front has advanced and is now taking up a position on Hill 627 about two and one-half miles southeast of here. Our cavalry has defeated the hostile cavalry and driven it to the eastward.

This command will at once attack the enemy, enveloping his left. The rôle of the advance guard as such will now cease.

The artillery battalion will proceed south on the road past the NEWMAN place to the farm road about one and one-half miles south of here, thence east across PLUM CREEK and take position north of the said farm road and support the attack. In moving to position it will leave the road where necessary to gain cover from hostile view.

The third infantry will follow the route prescribed for the artillery and after crossing PLUM CREEK will move to the attack, its left near the 618-565 road.

The second infantry will attack along the road they now are on, but will not advance beyond WHITEHALL S. H. until the artillery opens fire. They will later push the attack in support of the third infantry.

The first infantry will form the reserve and will follow in rear of the left flank of the third infantry.

The cavalry will cover our left flank, sending patrols to observe on our right.

The signal company will run a line connecting me with BONNEAUVILLE and with the second infantry.

The ambulance company will follow the reserve to the crossing of PLUM CREEK and there await further orders.

Messages to cross roads 613.

The leading of the battalion of field artillery under the situation and orders just given will now be taken up. At this hour, 6:30 A. M., the Blue column is on the BONNEAUVILLE-WHITEHALL road:

Head of support at WHITEHALL cross roads.

Head of reserve, advance guard at grove 500 yards N. W. of WHITEHALL.

Head of main body at ST. LUKE'S CHURCH.

Head of the artillery battalion about 250 yards N. W. of ST. LUKE'S CHURCH; tail near SWEETHOME S. H.

Third infantry is following the artillery battalion with its tail near 572.

The first infantry, artillery combat train, etc., have not yet cleared BONNEAUVILLE.

General A is at ST. LUKE'S CHURCH with the officers previously mentioned. Major A, the field artillery commander, has been with him since the march began that morning. He has knowledge of all the reports that have come in and has more or less of a good idea of the General's estimate of the situation and of his decision. He has heard the attack order as issued and has required his adjutant to make notes of the same as it was given out.

LOCATION OF THE FIELD ARTILLERY BATTALION STAFF AND SPECIALISTS

The field artillery major's staff and specialists consist of:

One captain, adjutant and reconnaissance officer.

One lieutenant, supply officer.

One sergeant major.

One supply sergeant.

Two mounted orderlies (horseholders).

Three agents (corporals).

Three scouts (corporals).

Four scouts (privates).

One signal corporal and telephone operator.

One signal private and telephone operator.

One corporal, instrument operator.

One musician.

Two drivers (privates) of the battalion reel cart.

All of the above staff and specialists are individually mounted except the reel cart drivers who ride the near horses of their pairs and the signal private. In this problem, the major is at liberty to draw on the batteries for assistance to conduct his

reconnaissance and look out for security. This, however, is bad practice as it breaks up the battery details and should always be avoided when possible. In this particular problem there is no excuse for such procedure. The major's assistants are sufficient for all reasonable purposes.

As combat could be reasonably expected at some stage of the march that day, the major disposed of his staff and specialists to suit the circumstances. Contact with the enemy was lost during the night and General A has made his cavalry independent this morning in order that it may have the necessary latitude to move out and regain this contact. Artillery reconnaissance details attached to independent cavalry cannot ordinarily expect to have the cavalry await any detailed work on their part. The cavalry has its mission which, in the general case, must take precedence over any technical artillery work and artillery details so attached to independent cavalry must take advantage of such opportunities as present themselves and not claim them as a matter of right. For this reason it would not be policy for Major A to detail any large reconnaissance party to go out with the independent cavalry. The attachment of two or three competent men, however, would be of advantage in this way: The hostile troops being inferior in strength to the Blues are very likely to take up a position in readiness or a defensive position. In such case, the independent cavalry would undoubtedly endeavor to locate the flanks of the hostile position and the position of the reserves, etc. This close reconnaissance may disclose the position of the hostile batteries. This is a matter of great importance to the artillery major and the presence of one or more of his trained specialists with the cavalry command would probably result in his getting better and more usable information than if the matter were left entirely to the cavalry. For this reason, if one or two competent men can be spared, there is no objection to their detail with the independent cavalry. Cavalry having such details attached should bear in mind that any assistance they can give to the detail is simply a part of the great game of team play and coöperation. Also they should

bear in mind that specialist details of the artillery being absent, definite and precise information as to the location of the hostile batteries, limbers, combat trains, etc., with respect to conspicuous landmarks will be invaluable technical information to the artillery and cavalry should be instructed more or less as to what information is valuable in this respect and what is useless.

Were the cavalry attached to the advance guard this morning there would be no doubt as to the advisability of attaching an artillery reconnaissance detail thereto and in this case, the sending of a detail with the infantry advance guard is so obvious as to need no further comment.

The major himself should ride with the General's party and should be accompanied by his orderly, one of his staff officers and the latter's orderly, one or more of the agents, and all of the remaining scouts. The number of mounted men with the major should be reduced to a minimum when he is riding with or near the General's party for obvious reasons. Therefore, although combat is imminent the captains and their reconnaissance details need not be present but farther back down the column. They should not be farther back, however, than the head of the artillery battalion and orders for them to ride there available for immediate reconnaissance duty would be appropriate. The march of the batteries can be conducted by the lieutenants. On this particular morning the battalion supply officer can be regarded as being of more value to the organization up at the front than back in his normal place with the trains, the trains being entrusted to the supply sergeant. The reel cart and any men not specially detailed for duty elsewhere had better march under the sergeant major at the head of the battalion.

A reasonable disposition of the battalion staff and specialists and of the captains and their reconnaissance details would therefore be:

With the independent cavalry, one scout corporal and one scout private.

With the advance guard, the battalion supply officer and orderly, one scout corporal and one or more scout.

With the major, the battalion adjutant and their orderlies, the remaining scouts and the agents.

At the head of the battalion, the remainder of the major's staff and specialists, the reel cart under the sergeant major, and the three captains and the reconnaissance details.

With the field trains, the battalion supply sergeant.

It may be assumed that the reconnaissance details with the advance guard and with the major were more or less employed up to 6:30 A. M. and that the decision with respect to the use of the artillery in the coming combat was made as the result of their observation and the advice of the major.

Major A's Estimate of the Situation at 6:30 A. M.: Defects in the combat order are first likely to attract his attention. These are:

First: The order specifies very definitely the route of the battalion to position. This would be a defect and would have to be changed if the next line of the order did not authorize the battalion to depart from the specified route when necessary to keep under cover. Though the order is verbose and unnecessarily detailed, the intent is clear and no mention need be made of this matter.

Second: The attack of the second infantry is dependent upon the opening of fire by the field artillery. This method of inaugurating an attack has been responsible for some notorious disasters and Major A must exercise great care as to when he opens fire. Under these circumstances it is imperative that one or more artillery agents go with the second infantry.

Continuing his estimate, Major A notes the woods south of St. Luke's Church and the ravine and woods south of the place in which the field artillery is ordered to take station. So far as he knows this ground has not been thoroughly reconnoitered and may be occupied by advance troops or patrols of the enemy. It would thus be inadvisable to trot the artillery to position or otherwise advance it until the third infantry has made some reconnaissance of the locality as it undoubtedly will do in the next few minutes. It would also be inadvisable for Major A to start any reconnaissance with his captains of the artillery position until reasonably sure that hostile troops are not hidden in that locality. Disablement or capture of the battalion staff and of the captains and their staffs or the fire of a combat patrol into the battalion itself would seriously delay the occupation of the position and while chances must at times be taken there is no necessity for such chances being taken in this case.

It is a dry, June day and the major notes that the roads are very dusty. Trotting the battalion to position would result only in marking out its course to the hostile troops. The advance to position must be made at a walk and conducted very carefully to prevent this very thing.

If possible, fire should not be opened until the third infantry is in position to begin its attack which will probably be somewhere near Plum Creek or crossroads 613. Otherwise, the second infantry, hearing the guns will launch its attack and the infantry combat will be started piecemeal.

Major A therefore decides: To direct his battalion to march with the third infantry to where the farm road crosses Plum Creek and there halt awaiting further orders; to order his captains and their reconnaissance details to report to him on the St. Luke's nose for orientation as to the situation and to proceed with them to the area assigned to his battalion as its battle position for the detailed reconnaissance of position just as soon as the advance of the third infantry renders such a movement on his part a safe procedure.

ACTIONS AND ORDERS OF MAJOR A*

Major A called up one of the corporal agents of his staff and gave him the following order:

"The enemy has gone into position about two and one-half miles south-east down this road. The General intends to attack him at once. Do you see that orchard (pointing to the orchard at A)? The artillery battalion is going into position just south of that orchard. You will report to the adjutant of the second infantry (that officer standing over there talking to his colonel) and accompany the second infantry in its advance down this road. Keep me informed as to the situation in the second infantry during the attack. You will find Lieutenant B (battalion supply officer)

*The points A, B, C, D, and E are referred to hereafter in the leading of this battalion. The reader should mark them on his map.

A, is the orchard 350 yards southeast of the crossroads, 587 W.

B, is the farmhouse at the junction of the farm road 610-613 and Plum Creek.

C, is the wire fence parallel to the 587W-621 road just north of the orchard at A.

D, is the first wire fence north of the 610-613 farm road.

E, is a point on the farm road 613-610 midway between Plum Creek and the first nose east of Plum Creek.

somewhere ahead of you down that road. Tell him to report back to me. I will be near that orchard (A)"

Major A then turned to the adjutant of the third infantry who was nearby and said:

"My battalion will accompany your regiment in the march towards 618 but will probably have to go across fields to keep deflated."

With his staff, the major now rode into the field west of St. Luke's Church. He had noted that the road near the church is visible from the hill 647 just northeast of the hostile position on hill 627. He now orders his adjutant:

"Take the combat train agent and ride up to the battalion. Direct the captains to report to me here with their reconnaissance details. Explain the situation to the senior officer with the battalion and direct him to march the battalion under convoy of the third infantry to where that farm road crosses Plum Creek and to halt there and await orders. He is to keep deflated from hills 627 and 647 and avoid stirring up dust. Send the agent on to the combat trains with orders for the combat train commander to march the trains to the vicinity of crossroads 621 via GARVER and await orders there. You report back here."

At 6:50 A. M. the captains have reported and the battalion adjutant has returned. The general and his staff are just west of the church waiting for the column to start. The major moves his assembled party up nearer the crest of the nose and dismounting explains the situation fully to the captains who in turn explained it to their reconnaissance details. This is completed by 7:10 A. M. at which hour the following may be noted: The two leading battalions of the second infantry have cleared the road, Whitehall-Whitehall S. H. The third battalion of this regiment has closed up on Shebly. The artillery battalion is moving across the fields toward 617 followed by the first infantry while the third infantry is moving along the road past the church and toward Newman. The mounted scouts of the third infantry have just disappeared into the woods near 617. As a precaution the major turns to one of his agents and orders:

"Go down to those crossroads (pointing to the 617 crossroads) and guide the battalion into that farmhouse (pointing to the farmhouse at B and marking it on the scout's map). Tell the senior officer that that is where I wish him to halt the battalion and await further orders. I am going now with the captains to that orchard (A). You rejoin me there."

The major now takes one of his corporal scouts and rides up to the General's party. He reports to the brigade adjutant that he is now going to reconnoiter his position and will report next at the 613 crossroads (the general's battle position). The major assures himself that the corporal scout understands the situation, particularly as to where the batteries will be, and directs him to report to the brigade adjutant for duty with the general's headquarters. Major A then rejoins his captains and with the captains, their battery reconnaissance details and the remainder of his own staff rides rapidly across fields to the orchard at A, keeping under cover as far as possible from hills 647 and 627.

The party dismounts under cover of the orchard and the officers go forward to the crest of the nose just east of the orchard where they study the enemy's position and the intervening ground. Hostile infantry can be seen on hill 627 but otherwise the enemy is invisible. The major and the other officers then retire through the orchard to its south edge where the major orders:

"The situation appears to remain unchanged since we left the church.

"The battalion will go into position on the west slope of this ridge with flash defilade against hills 627 and 647.

" 'A' battery will unlimber with its left on that wire fence, C.

" 'C' battery with its left on that wire fence, D.

" 'B' battery midway between 'A' and 'C' batteries. All batteries will be posted *in observation*. 'A' and 'C' batteries *counter batteries* and 'B' battery an *infantry battery*. No fire until I order it.

The combat trains have been ordered to 621 crossroads.

"Battalion headquarters will be back there where we just were in front of the orchard.

"The adjutant will establish my observing station at that point (just east of A on the map) and run a telephone line from there through the battery observing stations. The reel cart will continue the line down to that farm road (marked E on map) and under the sergeant major wait orders there. I intend to have it follow the reserve infantry regiment. Captain A, have Lieutenant Z of your battery report to me. I am going now to meet the third infantry and shall probably return in twenty minutes. Captain A will take command in my absence."

The major takes his orderly and musician and rides rapidly to meet the third infantry, going via the farmhouse (B) and the farm road.

The adjutant dispatches a man to meet the battalion which can be heard moving along the 617-621 road, with orders to have the reel cart and the battalion instruments brought directly up to the orchard (A) to which point the adjutant and the remainder of the battalion staff repair.

THE ACTIONS AND ORDERS OF THE CAPTAIN OF "B" BATTERY

The captain mounted and calling to his detail to follow him rode to the point on the west slope of the nose where he desired to post his right gun and stationed a member of his detail to mark the spot. He then ordered his reconnaissance officer:

"Set up my station on the crest of the nose a little to the left of our probable line of fire (pointing). I am going to bring up the battery."

Note: Ordinarily the captain would prefer to get to work at his observing station, observing and identifying his targets, preparing firing data, etc., sending an agent to bring up the battery which would be put into position and the limbers and led horses posted by the battery executive officer. In this case, however, the captain has had some opportunity to study the hostile position and has been able to converse with his reconnaissance officer as to targets, etc. The position that the battery is to occupy is rather cramped as it is between the other two batteries and care must be exercised in posting the limbers to prevent their being in the line of any fire directed at the battery. Under these circumstances he prefers to put the battery in position himself.

The battery reconnaissance officer dismounted all the battery reconnaissance detail and sent the animals to be posted in the edge of the timber along the creek in rear of the position, pointing out a position which he judged would echelon them to one flank of the battery when it was in position. With the reconnaissance detail, the observing instrument and telephone material he went up the slope and set up the instrument so that a view could just be obtained over the crest, being very careful to keep defiladed from the hostile positions as much as possible. He selected and announced an aiming point and proceeded to obtain firing data for points on the hostile position on hill 627. The telephone detail stood ready to run a line to the battery as soon as it arrived and unlimbered. †

The captain taking only his orderly rode toward the farmhouse at B. As soon as his battery appeared coming east over the farm road, he took command of it and getting it out of column marched north with it parallel to the creek along the

east bank. When clear of the other troops he put it into double section column and commanded "Form for action."

At this command the first caisson of the fifth section which was marching at the rear of the battery took and increased gait and put itself at the head of the battery. When approximately abreast of the position of his right gun which he had marked by the mounted man previously mentioned, he changed direction to his right (east) and formed left front into line with the guide to the right, halted the battery when it arrived on the selected line and commanded:

"Action front! Prepare for action!"

At this command, the battery unlimbered on the line and the guns were made ready for firing. According to directions previously given by the captain, the first sergeant moved the limbers to the rear at a walk and posted them in line with full intervals facing to the front in the edge of the timber along the east bank of the creek, echeloned a little to the right flank of the line of guns. The captain went up to his observing station, and finding that his reconnaissance officer had prepared all the necessary data for opening fire on the hostile infantry line on hill 627 commanded the battery through his megaphone: "Report for firing data."

At this command, the executive and assistant executive chiefs of section and the gunners reported, coming up at the double time, the gunners carrying their panoramic sights. The captain then explained the tactical situation, pointing out the location of the various friendly units and the hostile position and briefly the plan of attack. He then announced:

Aiming point: The steeple of St. Luke's Church. (pointing)

Deflection 4620.

On 1st Piece, Close 2.

Site 305.

Corrector, 30.

Battery right.

Under the supervision of the chiefs of platoon and the chiefs of section, the gunners set their sights:

No. 1 at 4620.

No. 2 at 4618.

No. 3 at 4616.

No. 4 at 4614.

The captain then commanded: "Posts." At this command the officers, chiefs of section and the gunners returned to the guns at the double time and the pieces were laid. The range not having been announced, the guns were not loaded.

The captain and the battery reconnaissance officer busied themselves studying the hostile position. In the meantime the buzzer wire was laid by the battery signal detail from the captain's station to a point just in rear of the center of the line of guns of the battery with one telephone attached at his station and one at the battery. When the battalion commander's line was laid past the station of the captain, the third telephone of the battery equipment was attached and station opened.

ACTION AND ORDERS OF THE BATTALION ADJUTANT:

The battalion adjutant sent two men to the farmhouse about 400 yards north of the orchard A to remain in observation. He also directed the captain of "A" battery to send two dismounted men forward to the woods near 595 crossroads as a standing patrol. Upon arrival of the instruments, he established the battalion observing station near the orchard A and had the telephone detail run their line through the captains' observing stations and with the sergeant major in charge continue laying the line south to the farm road at E, where the cart and detail were ordered to halt and await further orders from the major. "A" battery and probably "B" battery have their observing stations so near the battalion station that the telephone is not necessary, but "C" battery station will probably be so remote that the telephonic communication will be required.

FURTHER ACTIONS AND ORDERS OF THE MAJOR

The major rode past the farmhouse at B and met the colonel of the third infantry on the farm road just west of where it crosses Plum Creek. Together they rode east along the farm road and halted under cover just west of 618, at which point, the colonel intended to issue his attack order. The colonel and the artillery major discussed the situation as they rode along. The substance of the conference was, that the position of the

artillery was pointed out to the colonel and Major A informed him that Lieutenant Z, who had just reported to Major A from the battalion would accompany the advance of the third infantry as agent. Also that he, Major A, intended to have the battalion reel cart follow the first (reserve regiment) infantry as far as possible, thus insuring telephonic communication from the reserve regiment up to his, Major A's, station. This was all satisfactory to the colonel.

Major A waited to hear the colonel's attack order given and then having given his sergeant major instructions to follow the first infantry, he rode rapidly in rear of the batteries up to his own station. The batteries were all in position and had reported "in order," to the battalion headquarters. Hostile artillery fire from the direction of hill 647 against the second infantry has been heard for the last half hour. The following message has just been received from the artillery scout with the second infantry.

"Second infantry, near WHITEHALL S. H. is under three inch shrapnel fire from Hill 647. Projectile furrows at the 593 crossroads bear on a point 40 miles north of the north edge of the orchard on Hill 647. Four fuse heads picked up here at the school house are set at 6.2, 6.0, 5.8 and 7.0 seconds respectively."

Lieutenant B, the battalion supply officer, who had previously come back from the second infantry in accordance with the major's orders reported that he had observed this battery's flashes and judged it to be about three hundred yards northeast of the northeast corner of the orchard on hill 647.

The major judging that the time was now ripe to fire, ordered "B" battery over the telephone to open fire on the hostile infantry on hill 627 and stop the entrenching there which it was evident was going on and sent Lieutenant B over to "A" battery with the message from the second infantry and with orders for "A" battery to attack the hostile battery on hill 647.

The captain of "A" battery drew a line on his map from the crossroads at 593 through a point 40 miles north of the orchard on hill 647. Referring to the reported fuse settings of the hostile shrapnel and disregarding the seven second setting as abnormal, he took the mean (6.0 seconds) as the probable

fuse setting. Referring to the range table for the hostile three inch guns, he noted that this corresponded to a range of about 2400 yards. Laying off 2400 yards on the above mentioned line from crossroads, 598, gave him a point on the map about 200 yards northeast of the northeast corner of the orchard on 647, as the probable location of the hostile battery. This corresponded very well with Lieutenant B's estimate of its location.

He immediately opened fire and adjusted on the southwest corner of the orchard on 647 and when adjustment was secured, shifted his sheaf by means of corrections obtained by map measurement and proceeded to search the probable area occupied by the hostile battery.

In the meantime a second hostile battery located by its flashes on hill 627 opened on the third infantry. "B" battery having stopped the infantry activity on hill 627, both "B" and "C" batteries were assigned to attack this second hostile battery.

* * * *

From time to time "B" battery was ordered to shift its fire to the infantry lines on hill 627 to stop work on the trenches there.

* * * *

When the firing line of the third infantry started to ascend the slope east of Alloway Creek, the hostile battery on hill 627 came into the open for direct fire. Both "B" and "C" batteries were ordered to attack it with shrapnel fire and as soon as it was immobilized, it was turned over to "C" battery for destruction by shell fire and "B" battery resumed its work on the hostile infantry. "A" battery had continued to engage the hostile battery on 647 with apparently little success as this battery continued to fire intermittently on the second infantry and it was apparent that the attack of that regiment would shortly be brought to a standstill. It did appear that the attack of the third regiment would succeed as it was still advancing slowly and had not yet absorbed all of the regimental reserve and the first infantry had not been used at all. At about this time the major received a message from the general to the effect that it was his opinion that the envelopment would succeed and that he,

Major A, assist fully in pushing that attack home. The hostile battery on 627 being now badly damaged, the major assigned the south half of the hostile infantry position to "C" battery and the north half to "B" battery. These batteries continued to assault this line with intermittent rafales, varying with the activity of the hostile infantry.

When the Blue firing line had reached the Grawmer place in front of 627, it was evident that the hostile troops were abandoning their lines and that the attack was going to be a success. The major, therefore directed "A" battery to limber up and join the troops in the Blue right wing. This battery having been previously warned that it would possibly soon be sent forward had its chests full of ammunition. When the order reached the captain he gave his orders as follows:

"Cease firing. March order. Limber rear. Executive report to me here at my station. Close station here. Reconnaissance detail mount."

When the executive arrived at the captain's station he gave him orders as follows:

"The attack of our third infantry is succeeding. The hostile troops are abandoning that 627 hill. We are ordered to join the troops in that (right) wing. Move the battery rapidly to those crossroads at 598 just southwest of the hill. I will precede you and give you further orders there."

The captain then mounted and with his reconnaissance detail rode at a gallop around the rear of the artillery position, thence via 618, 565 and after crossing the creek, across the fields to the lines of the third infantry which were now ascending the slopes of hill 627. In response to signals from the third infantry the major ordered "B" and "C" batteries to increase their range and search the east slope of hill 627.

ACTION AND ORDERS OF THE COMMANDER OF THE COMBAT TRAINS

Lieutenant X, upon receipt of the major's order brought to him by the agent, moved his train out of Bonneauville and going via Garver marched for the 621 crossroads. Upon arrival there, he parked the train off the road under cover of the woods and outposted his position with small patrols from his

reserve men, to the east and south. He then turned the train over to the second in command and taking the agent who had brought him the order rode to the edge of the woods east of 621 and directed the agent to rejoin the major and report the location of the combat trains. Lieutenant X kept rough track of the ammunition being expended in the batteries by counting the volleys, it being his intention to promptly forward some of his reserve caissons without orders if he judged the ammunition supply in any battery was running low. However, he was spared this action on his own initiative as he shortly received a message from the major directing him to advance the whole train up to the farmhouse at B from which point resupply of the firing batteries was a simple matter. His empty caissons he sent back to 621, for refilling from a section of the wagon train of artillery ammunition which had been ordered to that point by the general at the request of the major.

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